HYMO:
PROBLEM-ORIENTED COMPUTER LANGUAGE FOR HYDROLOGIC MODELING

Users Manual

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HYMO: PROBLEM-ORIENTED COMPUTER LANGUAGE FOR HYDROLOGIC MODELING

Users Manual

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INTRODUCTION

HYMO *(7)*[3] is a problem-oriented computer language for modeling surface runoff and sediment yield from watersheds. The language is called HYMO from the words "hydrologic model." HYMO was designed for planning flood prevention projects, forecasting floods, and research studies. It consists of a main program and 16 subroutines written in FORTRAN IV, but it can be used by hydrologists with little knowledge of computer programing. The language provides 17 commands for the hydrologist to use in any sequence for application to any watershed.

HYMO was designed to transform rainfall data into runoff hydrographs and to route these hydrographs through streams and valleys or reservoirs. It will also compute the amount of sediment produced by a storm at any point on a watershed. It will be useful to research hydrologists in studying the effects of watershed and storm characteristics on the flood hydrograph. HYMO is also a good research tool for testing hydrologic procedures; for example, a new flood-routing method could be added to HYMO and tested easily, because the inflow hydrographs and the rating curves are available in a HYMO program.

HYMO is flexible. Present hydrologic procedures can be modified or deleted, and other hydrologic procedures can be added by hydrologists familiar with FORTRAN IV programing. Adding a new command simply requires the addition of a new subroutine.

HYMO is efficient, practical, and generally applicable. HYMO programs can be written and the results interpreted by hydrologists who have no conventional computer programing experience. The hydrologic procedures used in HYMO are practical — required inputs are easy to obtain for most watersheds.

HYMO was written for the IBM 360-65 computer, but it could be run on an IBM 1130 with little modification. The storage requirement is about 73 K.

OPERATION OF HYMO

HYMO consists of a main program and 16 subroutines. The HYMO card deck is set up in the following order:

1. Main program.
2. Subroutines.
3. A data card containing the number of commands in the command table.
4. A data card containing the ZALFA array.
5. Seventeen data cards containing the command table.
6. The users program deck consisting of program and data cards.

A printout of the main program, subroutines, ZALFA array, and command table is given in the appendix.

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[3]Italicized number in parentheses refer to items in "Literature Cited" preceding the appendix.

The main program reads the command table and then calls the HONDO subroutine (*2*) to read a program data card. Subroutine HONDO determines the command name and number by comparing columns 1 through 20 of the program data card with the command table. Then HONDO determines individual data items by comparing columns 21 through 80 of the program data card with the ZALFA array. The data are placed in an array and returned to the main program. Based on the command number, the main program calls the proper subroutine to do the desired calculations. When the calculations are complete, control is returned to the main program, and HONDO is called again to read the next program card.

HYDROLOGIC PROCEDURES USED IN HYMO

The procedures used in HYMO were selected because of their accuracy, general applicability, practicality of inputs, and computational efficiency. For most watersheds the input is easy to obtain, and the procedures produce reasonably accurate results without excessive computer time.

Hydrograph Computation

When flood routing is performed, a watershed is divided into many small areas according to its hydraulic characteristics. The hydrographs from these areas must be estimated, since streamflow measurements are seldom available. A procedure for computing unit hydrographs was developed previously (*4*). A modification of this procedure is used in HYMO. Unit hydrographs are divided into three parts for computation (fig. 1). From the beginning of rise to the inflection point, t_0, the hydrograph is computed by the two-parameter gamma distribution equation

$$q = q_p \left[t/t_p\right]^{(n-1)} e^{(1-n)(t/t_p-1)} \quad (1)$$

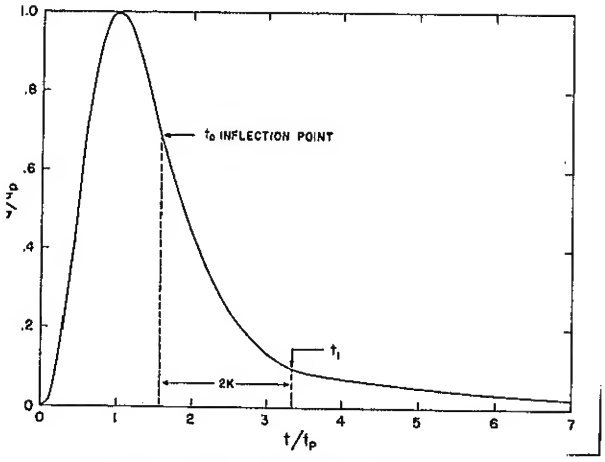


Figure 1. Dimensionless unit hydrograph.

where q = flow rate in cubic feet per second at time t,
q_p = peak flow rate in cubic feet per second,
t_p = time to peak in hours,
and n = dimensionless parameter.

From t_0 to t_1 ($t_1 = t_0 + 2K$) the hydrograph is computed by the recession depletion equation

$$q = q_0 e^{\frac{t_0 - t}{K}} \quad (2)$$

where q_0 = flow rate at the inflection point,
t_0 = time at the inflection point,
and K = recession constant in hours.

From t_1 to ∞ the recession depletion equation becomes

$$q = q_1 e^{\frac{t_1 - t}{K_1}} \quad (3)$$

where q_1 = flow rate at t_1,
and K_1 = $3K$ = second recession constant.

The dimensionless shape parameter, n, is a function of K/t_p, as shown in figure 2. The peak flow rate is computed by the equation

$$q_p = \frac{BAQ}{t_p} \quad (4)$$

where B = a watershed parameter, a function of n as shown in figure 3,
A = watershed area in square miles,
and Q = volume of runoff in inches.

Therefore, the entire unit hydrograph can be computed if K and t_p are known. K and t_p can be determined by hydrograph analysis (*4*) for gaged watersheds. To compute K and t_p for ungaged watersheds, HYMO uses the equations:

$$K = 27.0A^{0.231}SLP^{-0.777}(L/W)^{0.124} \quad (5)$$

and $tp = 4.63A^{0.422}SLP^{-0.46}(L/W)^{0.133}$ (6)

where SLP = difference in elevation in feet, divided by flood-plain distance in miles, between watershed outlet and most distant point on the watershed,

and L/W = watershed length-width ratio.

Storm hydrographs are computed by convolving unit hydrographs with incremental source runoff. To compute incremental source runoff, the mass rainfall curve is broken into equal time increments, and the Soil Conservation Service (SCS) rainfall-runoff relationship (*3*) is applied. The SCS rainfall-runoff relationship is expressed in a set of numbered curves. The SCS National Engineering Handbook (*3*) provides detailed instructions for selecting the proper curve number.

Hydrographs computed by this procedure compared closely with measured hydrographs from 34 watersheds located in Texas, Oklahoma, Arkansas, Louisiana, Mississippi, and Tennessee. The watershed areas ranged from 0.5 to 25 square miles.

Flood Routing

Streams and valleys

The variable storage coefficient (VSC) flood-routing method (*5*) was selected for HYMO.

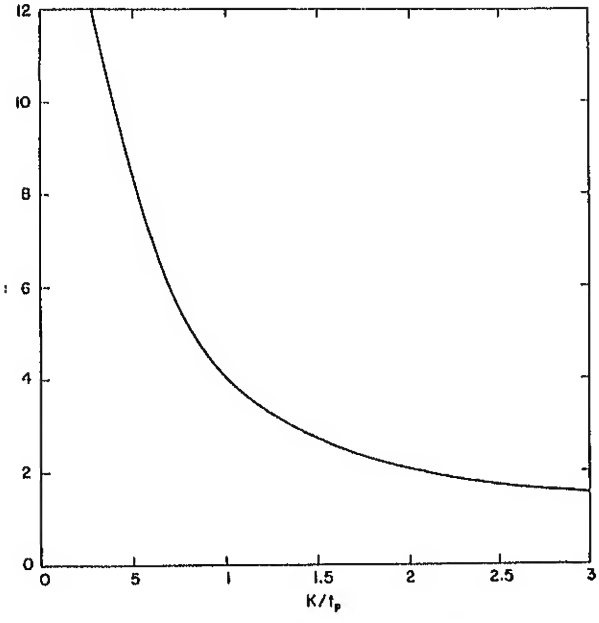


Figure 2. Relationship between dimensionless shape parameter and recession constant/time to peak.

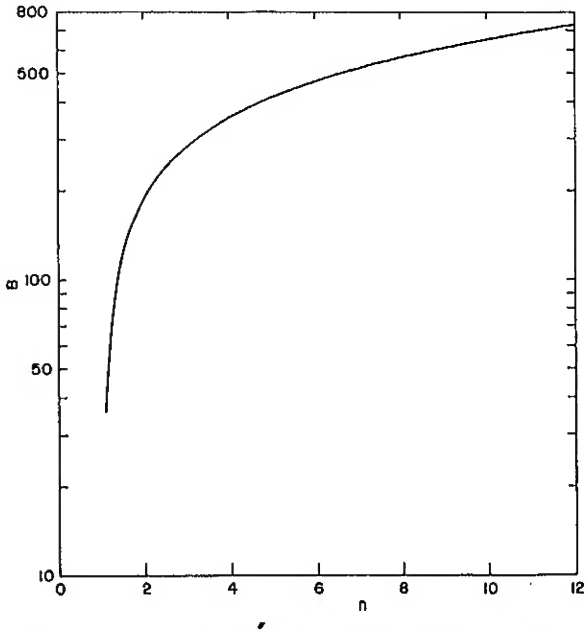


Figure 3. Relationship between dimensionless shape parameter n and watershed parameter B.

The VSC method has been revised (*6*) to account for the variation in water surface slope during a flood. The revised VSC method is about as accurate as the implicit method (*1*) and has the general applicability of simpler storage methods. Although an iterative solution is used, the VSC method requires little computer time and is free of convergence problems.

The VSC routing equations are

$$O_2 = C_2\left[I_a + \left(\frac{1}{C_1} - 1\right) O_1\right]. \quad (7)$$

$$C_2 = \frac{2\Delta t}{2T_2 + \Delta t}. \quad (8)$$

$$C_1 = \frac{2\Delta t}{2T_1 + \Delta t}. \quad (9)$$

$$T_1 = \left(\frac{L}{1800(V_{I_1} + V_{O_1})}\right) X \left(\frac{L \times SLP_0}{L \times SLP_0 + D_{I_1} - D_{O_1}}\right)^{1/2} \quad (10)$$

$$T_2 = \left(\frac{L}{1800(V_{I_2} + V_{O_2})}\right) X \left(\frac{L \times SLP_0}{L \times SLP_0 + D_{I_2} - D_{O_2}}\right)^{1/2} \quad (11)$$

In these equations subscripts 1 and 2 refer to the beginning and end of the time interval Δt; the units are cubic feet per second for flow, hours for time, feet per second for velocity, and feet for length and depth. The symbols are defined as follows:

I = inflow rate.
O = outflow rate.
$I_a = \frac{I_1 + I_2}{2}$ = average inflow rate.
C = storage coefficient.
T = travel time through the reach.
L = reach length.
V = velocity.
SLP_0 = normal slope.
D = depth.

Since T_2 and C_2 are dependent upon O_2, an iterative technique is required to solve the routing equations. In equation 7, I_a and O_1 are known, and C_1 can be computed from equation 9. This leaves only O_2 and C_2 as unknowns. O_1 can be used as a first approximation of O_2. The normal depth and velocity for the approximate value of O_2 are entered into equation 11 for computing T_2. Then equation 8 is used to compute C_2. The second approximation of O_2 is then obtained from equation 7. This iterative process continues until the difference between successive O_2 values is acceptable. HYMO is set to accept differences of 0.1 percent or less. Usually about four iterations are required.

Reservoirs

HYMO uses the storage-indication method (*3*) to route floods through reservoirs. This method has been widely used and accepted because it is practical and accurate. The SCS National Engineering Handbook gives detailed instructions for using the method.

Rating Curves

Rating curves must be available at enough locations along a valley to adequately describe the hydraulics of the stream and valley. Most of these rating curves must be computed because there are never enough measured rating curves.

HYMO uses Manning's equation to compute the normal flow-rating curves that are used in the VSC flood-routing method. The normal flood-plain slope is determined for each valley section by plotting a profile of the flood plain. The normal channel slope is determined by plotting a profile of the flood plain with channel distances.

Sediment Yields

The universal soil loss equation (*8*) was modified to compute the sediment yield for individual storms on watersheds. The modified equation is

$$S = 95\,(q_p \times Q)^{0.56} \times K \times C \times P \times LS, \qquad (12)$$

where S = sediment yield in tons,
q_p = peak flow rate in cubic feet per second,
Q = volume of runoff in acre-feet,
K = the soil-erodibility factor,
C = the cropping-management factor,
P = the erosion control practice factor,
and LS = the slope length and gradient factor.

Detailed instructions for determining K, C, P, and LS are given by Wischmeier and Smith (*8*).

Since equation 12 was designed to compute sediment yield from watersheds, a delivery ratio is not needed. The delivery ratio is built into equation 12 by including the peak flow rate. Many of the watershed characteristics that influence the peak flow rate also affect the delivery ratio. Equation 12 has performed well under limited testing, but future refinements are expected.

RULES FOR USING HYMO

The reader should refer to the table, "Example Input for HYMO Commands," as he follows the narrative description of the rules. The example HYMO program that is presented near the end of the manual may also be helpful.

General Rules

HYMO commands are expressed in the first 20 columns of the data card, and columns 21 through 79 are used for numeric data and keywords. Column 80 is reserved for a page-change code (an asterisk in column 80 causes the card to be printed on a new page). Continuation cards are allowed when 59 characters are insufficient to express the data.

The data can be written in any format, but at least one blank space must be left between data items. A decimal is required for numbers con-

taining fractions, but not for whole numbers. Keywords can be written with the data to describe individual data items. Comment cards may be used at any point in a HYMO program by punching an asterisk in column 1 and the comment in columns 2 through 79.

Example input for HYMO commands

Command	Required input
START	RAINFALL BEGINS AT 12.5 HRS PUNCH CODE=1
STORE HYD	ID=1 HYD NO=301 DT=.2 HR DA=1.5 SQ MI FLOW RATES= 0 10 50 100 500 1000 1800 2000 1900 1500 1200 1000 800 600 500 400 300 200 100 50 10 1
COMPUTE HYD	ID=2 HYD NO=302 DT=.5 HR DA=2.1 SQ MI CN=90 HT=100 FT L=3.3 MI MASS RAINFALL = 0 .31 .61 1.04 1.84 2.74 3.06 3.45 4.33 4.75
PRINT HYD	ID=2 CODE=1
PUNCH HYD	ID=2
PLOT HYD	ID I=3 ID II=4
ADD HYD	ID=4 HYD NO=101 ID I=5 ID II=6
STORE RATING CURVE	ID=2 VS NO=15 ELEV AREA FLOW 496.6 0 0 497 2 1 498 9 19 499 19 52 500 30 98
COMPUTE RATING CURVE	ID=1 VS NO=10 NO SEGS=3 MIN ELEV=482 FT MAX ELEV=492 FT CH SLP=.006 FP SLP=.0075 N=.05 DIST=175 FT N=.03 DIST=205 FT N=.05 DIST=450 FT DIST ELEV DIST ELEV DIST ELEV DIST ELEV 0 492.0 100 490.0 175 484.0 188 482.0 190 482.0 205 484.0 250 486.0 275 488.0 310 490.0 450 492.0
COMPUTE TRAVEL TIME	ID=3 REACH NO=8 NO VS=5 L=4500 FT SLP=.0075
ROUTE	ID=3 HYD NO=8 INFLOW ID=6 DT=.25 HR
ROUTE RESERVOIR	ID=5 HYD NO=501 INFLOW ID=1 OUTFLOW (CFS) STORAGE (AC FT) 0 0 22 533 200 555 1000 601 2000 648 3000 694
ERROR ANALYSIS	ID I=3 ID II=5
SEDIMENT YIELD	ID=5 SOIL=.34 CROP=.5 EP=.6 LS=.3
FINISH	

Six hydrographs can be stored in a HYMO program at a time. The hydrographs are identified by storage location numbers 1 through 6. Therefore, the same storage location number must be used for many hydrographs in a HYMO program. This is especially true when routing is done through large watersheds. However, no more than six hydrographs are ever needed at one time because HYMO programs begin at the head of a watershed and work downstream through one reach at a time. When a storage location number is used to store or compute another hydrograph, the first hydrograph is lost. The user should be sure that the hydrograph will not be referred to again before using the storage location number for another command.

To store, compute, or route a hydrograph, the user must specify the time increment. There are no rigid rules about selecting the time increment, but generally it should not be greater than one-fifth of the time to the peak of the hydrograph. This rule usually provides enough points to adequately define the hydrograph. All hydrographs are limited to 300 points.

For the commands "STORE HYD," "COMPUTE HYD," "ADD HYD," "ROUTE," and "ROUTE RESERVOIR," the user must specify the number of the outflow hydrograph. The hydrograph identification numbers are used to designate specific routing reaches, incremental areas, reservoirs, and partial hydrographs. The partial hydrograph number is given to all hydrographs other than outflow hydrographs from reaches, incremental areas, or reservoirs. The identification numbers for each group are

Reaches	1-100
Partial hydrographs	101-300
Incremental areas	301-500
Reservoirs	501+

Command Rules

The first command for any watershed is START. The two data items associated with this command are the time rainfall begins on the watershed and a code for punching output data. If a storm is to be routed through a watershed only once, the punch code is deleted. However, if more than one routing is to be performed, set the punch code equal to a positive number, and the output data for the first routing will be punched for use in the second routing. More than one routing is usually required.

Two commands, RECALL HYD and STORE TRAVEL TIME, were designed to be computer punched for second routings; consequently, these commands do not appear in the table.

The STORE HYD command is used to store the coordinates of a hydrograph in the computer. It can be used for storing measured hydrographs or hydrographs computed by methods other than the one used in HYMO. The input data required for STORE HYD are storage location number, hydrograph identification number, time increment, watershed area, and flow rates of the hydrograph at the specified time increment.

The COMPUTE HYD command is used to compute hydrographs from the incremental areas of the watershed. The first five items of data are storage location number, hydrograph identification number, time increment, watershed area, and SCS runoff curve number (*3*). Normally, data items 6 and 7 are watershed height and main stem length. The height and length are used to compute the recession constant K and the time to peak t_p. However, if K and t_p are known or estimated by some other method, they can be entered directly into the program. This is accomplished by placing a minus sign before the values of K and t_p and entering them as data items 6 and 7, respectively. The remaining data items are values of the mass rainfall at the specified time increment.

Since most watersheds have a limited number of rain gages, the same mass rainfall data may be used to develop several hydrographs. Once the mass rainfall data have been entered in a COMPUTE HYD command, they can be repeated for any number of COMPUTE HYD commands without repunching the data. Instead, punch a negative number for the eighth data item of all COMPUTE HYD commands that use the same rain gage. When data from another rain gage are entered, the data from the first rain gage are lost and cannot be recalled by using the negative number code.

The RECALL HYD command is one of the two commands that are computer punched. When the punch code is a positive number, the output from STORE HYD and COMPUTE HYD are punched on cards with the RECALL HYD command. The RECALL HYD command stores

the computed and stored hydrographs on cards; it is therefore not necessary to recompute hydrographs for future routings. Instead, the previously computed hydrographs are read into the program, thus saving considerable computer time.

Although the input data for the RECALL HYD command are never punched manually, a list of the data items may be helpful in checking computer-punched cards. The input data are storage location number, hydrograph identification number, time increment, drainage area, peak flow rate, runoff volume, number of hydrograph points, and flow rates of the hydrograph.

The PRINT HYD command is used to print coordinates of a hydrograph, volume of runoff, and peak flow rate. The required input data are the storage location number and a peak-volume code. The peak-volume code is deleted if a complete hydrograph printout is desired. If a printout of only the runoff volume and the peak flow rate is needed, the peak-volume code is set to a positive value.

The PUNCH HYD command is used to punch any hydrograph in a HYMO program in the proper form for the RECALL HYD command. PUNCH HYD has two purposes: (1) If the punch code is not used, PUNCH HYD can be used to punch one or more hydrographs for future use; and (2) if it is desirable to punch outflow hydrographs associated with ROUTE, ROUTE RESERVOIR, or ADD HYD, PUNCH HYD must be used because the punch code only provides for punching hydrographs associated with STORE HYD and COMPUTE HYD. The only datum required for PUNCH HYD is the storage location number of the hydrograph to be punched.

The PLOT HYD command is used to plot hydrographs in a HYMO program. It will plot one hydrograph on a set of axes, or if a comparison is desired, it will plot two hydrographs on the same set of axes. The required input data are the storage location numbers of the hydrographs to be plotted.

The ADD HYD command adds the coordinates of any two hydrographs. The hydrographs are added at a time increment equal to that of the hydrograph with the shorter time increment. The only data required are the storage location number and hydrograph identification number of the added hydrograph and the storage location numbers of the two hydrographs to be added.

The STORE RATING CURVE command is used to store rating curves that have been measured or computed previously. STORE RATING CURVE will save considerable computer time if measured or computed rating curves are available. The input data are the storage location number, valley section number, and individual rating curve points described by elevation, end-area, and flow rate. The number of points used to describe a rating curve is limited to 20.

The COMPUTE RATING CURVE command is used to compute the stage-area-flow relationship for a valley section. The input data are storage location number, valley section number, number of segments in the valley section, minimum elevation, maximum elevation, channel and flood-plain slopes, Manning's n value and segment boundary point for each segment, and horizontal and vertical position of points describing the valley section.

The storage location numbers of the valley sections in a particular reach must begin with 1 and increase by one for each valley section in the reach. However, the numbers are assigned without regard to upstream or downstream order. The valley section identification number can be any number from 0.1 to 999.9. These rules concerning storage location and valley section identification numbers also apply to the STORE RATING CURVE command.

Normally, valley sections are divided into three segments (two flood-plain segments and a channel segment) for computing the rating curve. However, some valley sections may have more than one channel or may have an extreme variation in n values across the flood plain, thus requiring more than three segments. A maximum of six segments is permitted. Manning's n values for each segment are input with segment boundary point (distance from the beginning of the valley section to the end of the segment). Flood-plain n values are positive and channel n values are negative.

Twenty points are used to define a rating curve. The location of the points is determined by dividing the difference between the maximum and minimum elevations into 19 equal increments.

The COMPUTE TRAVEL TIME command is used to compute the normal flow travel time relationship used in ROUTE. The input data are storage location number, reach identification number, number of valley sections in the reach, reach length, and slope. The reach identification number can be any number from 0.1 to 999.9. The maximum number of valley sections per reach is six. The slope can be either the channel or flood-plain slope or a weighted average of the two. If flow is confined to the channel, the channel slope is of course applicable. If most of the flow is in the flood plain, usually the flood-plain slope is used. However, a weighted slope based on the relative rates of flow in the channel and the flood plain may be used.

The COMPUTE TRAVEL TIME command considers each rating curve in the reach in computing the travel time flow relationship. COMPUTE TRAVEL TIME automatically selects the flow rates that are used in computing individual travel times. The flow rates of the rating curve with the lowest maximum flow rate are chosen. If the flow rates of any other rating curve in the reach were chosen, the rating curve with the lowest maximum flow rate would have to be extrapolated. The travel time table is limited to 19 points because of the 20-point limit for rating curves.

The STORE TRAVEL TIME command is one of the two computer-punched commands. When the punch code is a positive number, the output from COMPUTE TRAVEL TIME is punched on cards with the STORE TRAVEL TIME command. Therefore, it is not necessary to recompute rating curves or travel time for future routings. Instead, STORE TRAVEL TIME reads the previously computed travel time flow relationship into the program, thus saving considerable computer time.

The input data for STORE TRAVEL TIME are not punched manually, but a list of data items may be helpful in checking computer-punched cards. The input data are storage location number, reach identification number, reach length, slope, and individual points of the relationship defined by depth, flow, and travel time.

The ROUTE command is used to route floods through streams and valleys. The input data are storage location number and hydrograph identification number of the outflow hydrograph, storage location number of the inflow hydrograph, and time increment. The storage location number of the outflow hydrograph must be the same as the storage location number used in COMPUTE TRAVEL TIME for the reach. To prevent unnecessary program stoppage, ROUTE extrapolates the travel-time table when it is exceeded and writes the message, "TRAVEL TIME TABLE EXCEEDED."

The ROUTE RESERVOIR command is used to route floods through reservoirs. The input data are storage location number and hydrograph identification number of the outflow hydrograph, storage location number of the inflow hydrograph, and individual points of the reservoir's outflow-storage relationship. The outflow-storage relationship must be expressed in 20 points or less. If the outflow-storage relationship is exceeded, ROUTE RESERVOIR will extrapolate the relationship and write the message, "STORAGE-DISCHARGE TABLE EXCEEDED."

The ERROR ANALYSIS command is used to determine the error standard deviation and the percentage error in peak flow between any two hydrographs in a HYMO program. These functions make ERROR ANALYSIS useful in research. The input data are the storage location numbers of the two hydrographs to be analyzed.

The SEDIMENT YIELD command is used to compute the sediment yield at any point in a watershed. Input data required are storage location number of the hydrograph from the area, a soils factor, a crop factor, a slope length and gradient factor, and a conservation practice factor (*8*).

The FINISH command is used to end HYMO programs. There are no data associated with FINISH.

EXAMPLE HYMO PROGRAM

A short example problem is presented to demonstrate HYMO. Figure 4 is a map of the 6.84-square-mile Brushy Creek watershed near Riesel, Tex. A flood will be routed through the watershed in its present condition, and the routed outflow hydrograph will be compared to

the hydrograph measured at gaging station G. Also the sediment yield will be predicted and compared with the measured sediment yield. Then the same flood will be routed through the watershed with two proposed reservoirs. To determine the effects of the reservoirs, the outflow hydrograph and sediment yield will be compared to the outflow hydrograph and sediment yield of the present-condition routing.

Comment cards and keywords are used liberally in the example problem to acquaint the user with HYMO. After becoming familiar with HYMO, the user may write fewer comments and keywords, but generally users find them both quite helpful in describing the problem. To save space in the example problem, few of the hydrographs are printed or plotted. Some users may choose to print and plot all hydrographs.

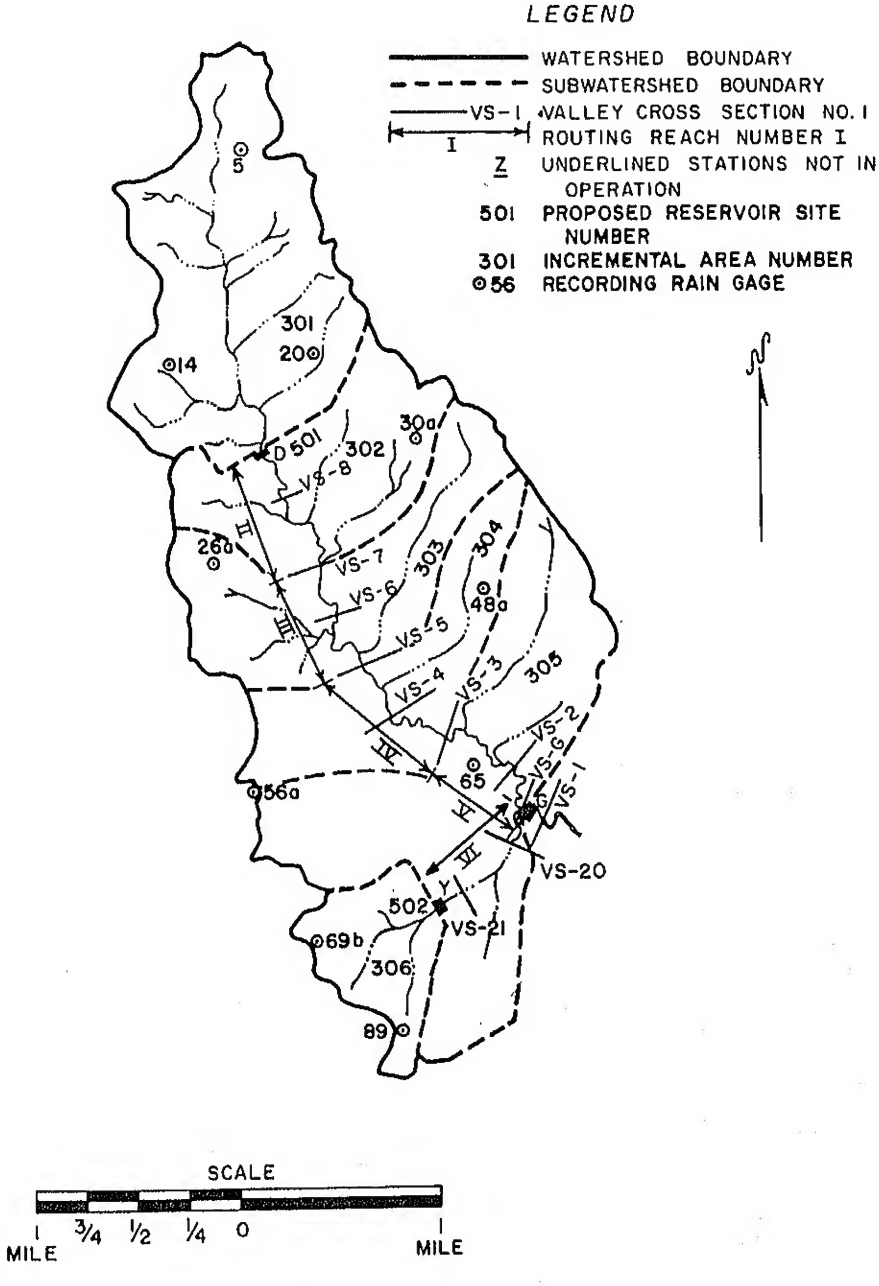


Figure 4. Brushy Creek watershed near Riesel, Tex.

```
*                          EXAMPLE HYMO PROGRAM
*
* TO PRINT ON A NEW PAGE AN ASTERISK IS PUNCHED IN COLUMN 80.
* COMMENTS ARE WRITTEN AT ANY POINT IN A HYMO PROGRAM BY PUNCHING AN
* ASTERISK IN COLUMN 1 AND THE COMMENT IN COLUMNS 2 - 79.
* THE FLOOD OF MARCH 29, 1965 WILL BE ROUTED THROUGH THE BRUSHY CREEK WATERSHED
* NEAR RIESEL, TEXAS.
* THE START COMMAND IS USED AT THE BEGINNING OF ALL HYMO PROGRAMS TO SET THE
* TIME RAINFALL BEGINS ON THE WATERSHED, AND TO INDICATE THE PUNCH CODE. THE
* PUNCH CODE IS USED TO PUNCH THE OUTPUT FOR USE IN FUTURE ROUTINGS. IF ONLY
* ONE ROUTING IS PLANNED, THE PUNCH CODE IS DELETED.
*
START               RAINFALL BEGINS AT 12.5 HRS   PUNCH CODE=1
*
* BEGINNING AT THE TOP OF THE WATERSHED THE FIRST STEP IS TO DETERMINE THE
* HYDROGRAPH FROM AREA 301. IT IS NOT NECESSARY TO COMPUTE THE HYDROGRAPH,
* BECAUSE IT WAS MEASURED PREVIOUSLY. THE STORE HYD COMMAND IS USED TO STORE
* THE MEASURED HYDROGRAPH IN THE PROGRAM.
*
STORE HYD           ID=1   HYD NO=301   DT=.1666667 HRS   DA=1.734 SQ MI
                    REMAINING DATA ARE FLOW RATES BEGINNNING AT
                    START TIME AND INCREMENTED BY DT 0 0 0 0 0 0
                    20 90 220 1025 1420 1380 2085 2260 2360 2110 1885 1890 1760
                    1560 1350 1150 1000 860 690 560 460 400 370 365 380 400 415
                    395 370 330 300 270 235 200 175 160 140 130 120 110 110 110
                    110 110 100 100 90 80 70 65 60 50 47 44 41 38 35 33 31 29
                    27 25 23 22 20 18 17 16 15 14 13 12 11 10 10 9 9 8 8 7 7 6
                    6 6 5 5 4 4 4 4 4 4 3 3 3 3 2 2 2 1
* THE PRINT HYD COMMAND IS USED TO PRINT THE HYDROGRAPH FROM AREA 301.
PRINT HYD           ID=1
```

HYDROGRAPH FROM AREA 301

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
12.500	0.	16.000	1150.	19.500	140.	23.000	33.	26.499	8.
12.667	0.	16.167	1000.	19.666	130.	23.166	31.	26.666	7.
12.833	0.	16.333	860.	19.833	120.	23.333	29.	26.833	7.
13.000	0.	16.500	690.	20.000	110.	23.500	27.	26.999	6.
13.167	0.	16.667	560.	20.166	110.	23.666	25.	27.166	6.
13.333	0.	16.833	460.	20.333	110.	23.833	23.	27.333	6.
13.500	20.	17.000	400.	20.500	110.	23.999	22.	27.499	5.
13.667	90.	17.167	370.	20.666	110.	24.166	20.	27.666	5.
13.833	220.	17.333	365.	20.833	100.	24.333	18.	27.833	4.
14.000	1025.	17.500	380.	21.000	100.	24.499	17.	27.999	4.
14.167	1420.	17.667	400.	21.166	90.	24.666	16.	28.166	4.
14.333	1380.	17.833	415.	21.333	80.	24.833	15.	28.333	4.
14.500	2085.	18.000	395.	21.500	70.	24.999	14.	28.499	4.
14.667	2260.	18.167	370.	21.666	65.	25.166	13.	28.666	3.
14.833	2360.	18.333	330.	21.833	60.	25.333	12.	28.833	3.
15.000	2110.	18.500	300.	22.000	50.	25.499	11.	28.999	3.
15.167	1885.	18.666	270.	22.166	47.	25.666	10.	29.166	3.
15.333	1890.	18.833	235.	22.333	44.	25.833	10.	29.333	2.
15.500	1760.	19.000	200.	22.500	41.	25.999	9.	29.499	2.
15.667	1560.	19.166	175.	22.666	38.	26.166	9.	29.666	2.
15.833	1350.	19.333	160.	22.833	35.	26.333	8.	29.832	1.

RUNOFF VOLUME = 4.933 INCHES
PEAK DISCHARGE RATE = 2360.0 CFS

```
* THE HYDROGRAPH FROM AREA 301 IS ROUTED THROUGH REACH 2. THE FIRST STEP IS TO *
* COMPUTE RATING CURVES FOR VALLEY SECTIONS 7 AND 8.
*
COMPUTE RATING CURVE ID=1   VS 8   3 SEGMENTS   MIN ELEV = 513.8 FT
                     MAX ELEV = 521 FT   CH SLOPE =.0026   FP SLOPE = .0033
                              N VALUE    DISTANCE
                     FIRST SEG   .05        414
                     SECOND SEG -.03        423
                     THIRD SEG   .05        602
                     THE REMAINING DATA DEFINE THE VALLEY CROSS SECTION
                               DISTANCE      ELEV
                                  10          521
                                  18          518.2
                                  30          519.1
                                 150          518.5
                                 200          518.1
                                 325          517.9
                                 345          516.1
                                 357          516.0
                                 370          517.1
                                 390          516.8
                                 414          514.7
                                 416          513.8
                                 419          513.8
                                 423          515.3
                                 450          514.7
                                 464          516.9
                                 474          516.8
                                 483          514.8
                                 492          516.4
                                 550          518.1
                                 600          520.8
                                 602          521.3

                        RATING CURVE VALLEY SECTION  8.0
                            WATER      FLOW       FLOW
                          SURFACE      AREA       RATE
                           ELEV        SQ FT      CFS
                          513.80        0.0        0.0
                          514.18        1.5        1.7
                          514.56        3.7        6.3
                          514.94        8.4       15.5
                          515.32       23.0       37.8
                          515.69       44.7       85.8
                          516.07       70.9      153.2
                          516.45      107.1      252.0
                          516.83      153.3      370.7
                          517.21      217.8      545.3
                          517.59      291.9      810.0
                          517.97      373.9     1064.2
                          518.35      505.3     1430.5
                          518.73      665.6     1979.6
                          519.10      858.7     2671.5
                          519.48     1069.9     3670.5
                          519.86     1284.1     4853.4
                          520.24     1501.3     6225.1
                          520.62     1721.7     7793.4
                          521.00     1944.8     9613.0
```

COMPUTE RATING CURVE ID=2 VS 7 3 SEGMENTS MIN ELEV=506.9 FT
MAX ELEV=515 FT CH SLOPE=.0018 FP SLOPE=.00245
N=.05 DIST=636 N=-.03 DIST=657 N=.05 DIST=2000

DIST	ELEV	DIST	ELEV	DIST	ELEV	DIST	ELEV
0	515.0	100	514.0				
390	513.6	550	512.0	600	510.6	636	511.3
641	506.9	647	506.9	657	510.8	748	510.4
772	512.5	800	511.7	850	511.7	1050	512.7
1200	513.1	1255	513.6	1800	514	2000	515

RATING CURVE VALLEY SECTION 7.0

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS
506.90	0.0	0.0
507.33	2.9	3.2
507.75	6.5	11.0
508.18	10.7	23.3
508.60	15.6	40.5
509.03	21.2	63.3
509.46	27.4	92.1
509.88	34.4	127.9
510.31	42.0	171.2
510.74	64.6	229.2
511.16	127.4	357.5
511.59	206.5	570.7
512.02	322.2	806.6
512.44	499.4	1204.4
512.87	739.0	1780.5
513.29	1054.1	2632.7
513.72	1428.1	3458.4
514.15	2074.3	4671.2
514.57	2845.0	7184.3
515.00	3670.1	10314.2

```
* BEFORE ROUTING THE TRAVEL TIME - DEPTH - FLOW RELATIONSHIP MUST BE COMPUTED  *
* FOR THE REACH.
*
COMPUTE TRAVEL TIME ID=2   REACH 2   2 VALLEY SECTIONS
                    REACH LENGTH=3400 FT   SLOPE=.0029
```

TRAVEL TIME TABLE
REACH 2.0

WATER DEPTH FEET	FLOW RATE CFS	TRAVEL TIME HRS
0.30	2.	0.8317
0.68	6.	0.5966
1.07	16.	0.4981
1.58	38.	0.4721
2.18	86.	0.3899
2.75	153.	0.3381
3.28	252.	0.3426
3.66	371.	0.3637
4.02	545.	0.3593
4.45	810.	0.3589
4.78	1064.	0.3598
5.13	1431.	0.3627
5.50	1980.	0.3526
5.86	2672.	0.3412
6.29	3670.	0.3359
6.67	4853.	0.3322
6.98	6225.	0.3074
7.29	7793.	0.2864
7.60	9613.	0.2667

```
* THE ROUTE COMMAND IS USED TO ROUTE THE HYDROGRAPH FROM AREA 301 THROUGH REACH*
* 2.
*
ROUTE                ID=2   HYD NO=101   INFLOW HYD ID=1   TIME INTERVAL=.2 HR
PRINT HYD            ID=2
```

PARTIAL HYDROGRAPH 101

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
12.500	0.	16.500	1031.	20.500	115.	24.500	21.	28.500	4.
12.700	0.	16.700	852.	20.700	112.	24.700	20.	28.700	4.
12.900	0.	16.900	696.	20.900	108.	24.900	18.	28.900	4.
13.100	0.	17.100	573.	21.100	102.	25.100	17.	29.100	4.
13.300	0.	17.300	490.	21.300	95.	25.300	15.	29.300	3.
13.500	2.	17.500	442.	21.500	85.	25.500	14.	29.500	3.
13.700	25.	17.700	422.	21.700	76.	25.700	12.	29.700	3.
13.900	163.	17.900	415.	21.900	68.	25.900	11.	29.900	2.
14.100	513.	18.100	406.	22.100	60.	26.100	11.	30.100	2.
14.300	864.	18.300	385.	22.300	54.	26.300	10.	30.300	2.
14.500	1251.	18.500	358.	22.500	49.	26.500	9.	30.500	2.
14.700	1674.	18.700	328.	22.700	45.	26.700	9.	30.700	2.
14.900	1937.	18.900	293.	22.900	41.	26.900	8.	30.900	2.
15.100	2004.	19.100	255.	23.100	38.	27.100	7.	31.100	1.
15.300	1957.	19.300	220.	23.300	35.	27.300	7.	31.300	1.
15.500	1890.	19.500	189.	23.500	33.	27.500	6.	31.500	1.
15.700	1765.	19.700	163.	23.700	30.	27.700	6.	31.700	1.
15.900	1589.	19.900	143.	23.900	28.	27.900	5.	31.900	1.
16.100	1398.	20.100	128.	24.100	26.	28.100	5.		
16.300	1214.	20.300	119.	24.300	23.	28.300	5.		

```
RUNOFF VOLUME =       4.940 INCHES
PEAK DISCHARGE RATE =     2004.2 CFS
```

```
* TO OBTAIN THE OUTFLOW HYD FROM REACH 2 THE HYD FROM AREA 302 MUST BE COMPUTED*
* AND ADDED TO THE ROUTED HYD 101.
*
COMPUTE HYD          ID=1   HYD NO=302   DT=.1666667 HR   DA=.837 SQ MI
                     CN=82   HEIGHT=69 FT   LENGTH=1.33 MI
                     REMAINING DATA DEFINE MASS RAINFALL FROM
                     START TIME TO END IN INCREMENTS OF DT   0 0 .18 .46 .57 .65
                     .89 1.45 2.05 2.7 3.15 3.5 4 4.49 4.72 4.78 4.92 5 5.06
                     5.06 5.06 5.06 5.06 5.11 5.2 5.3 5.31 5.31 5.32 5.34 5.43
                     5.59 5.84 5.84 5.85 5.85 5.86 5.86 5.86 5.87 5.87 5.88 5.88
                     5.88 5.92 6.09 6.11 6.13 6.15 6.15 6.16 6.16 6.17 6.18 6.18
                     6.19
    SHAPE CONSTANT, N =  2.208
    UNIT PEAK =       227.0CFS

PRINT HYD            ID=1
```

HYDROGRAPH FROM AREA 302

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
12.500	0.	17.667	193.	22.833	53.	27.999	12.	33.166	1.
12.667	0.	17.833	211.	23.000	49.	28.166	11.	33.332	1.
12.833	0.	18.000	219.	23.166	46.	28.333	11.	33.499	1.
13.000	0.	18.167	219.	23.333	43.	28.499	10.	33.666	1.
13.167	1.	18.333	212.	23.500	40.	28.666	10.	33.832	1.
13.333	2.	18.500	201.	23.666	37.	28.833	9.	33.999	1.
13.500	9.	18.666	188.	23.833	35.	28.999	9.	34.166	1.
13.667	36.	18.833	174.	23.999	33.	29.166	9.	34.332	1.
13.833	89.	19.000	160.	24.166	32.	29.333	8.	34.499	1.
14.000	169.	19.166	147.	24.333	30.	29.499	8.	34.666	0.
14.167	254.	19.333	135.	24.499	29.	29.666	8.	34.832	0.
14.333	332.	19.500	125.	24.666	27.	29.832	7.	34.999	0.
14.500	411.	19.666	115.	24.833	26.	29.999	7.	35.165	0.
14.667	491.	19.833	109.	24.999	25.	30.166	6.	35.332	0.
14.833	548.	20.000	117.	25.166	24.	30.332	6.	35.499	0.
15.000	570.	20.166	124.	25.333	23.	30.499	5.	35.665	0.
15.167	572.	20.333	127.	25.499	22.	30.666	5.	35.832	0.
15.333	558.	20.500	128.	25.666	21.	30.832	4.	35.999	0.
15.500	532.	20.666	125.	25.833	20.	30.999	4.	36.165	0.
15.667	495.	20.833	120.	25.999	19.	31.166	3.	36.332	0.
15.833	451.	21.000	113.	26.166	19.	31.332	3.	36.499	0.
16.000	407.	21.166	106.	26.333	18.	31.499	3.	36.665	0.
16.167	363.	21.333	99.	26.499	17.	31.666	2.	36.832	0.
16.333	326.	21.500	92.	26.666	16.	31.832	2.	36.999	0.
16.500	300.	21.666	86.	26.833	16.	31.999	2.	37.165	0.
16.667	282.	21.833	81.	26.999	15.	32.166	2.	37.332	0.
16.833	264.	22.000	75.	27.166	14.	32.332	2.	37.499	0.
17.000	244.	22.166	70.	27.333	14.	32.499	2.	37.665	0.
17.167	223.	22.333	65.	27.499	13.	32.666	2.	37.832	0.
17.333	204.	22.500	61.	27.666	13.	32.832	2.	37.999	0.
17.500	193.	22.666	57.	27.833	12.	32.999	1.		

RUNOFF VOLUME = 4.124 INCHES
PEAK DISCHARGE RATE = 572.0 CFS

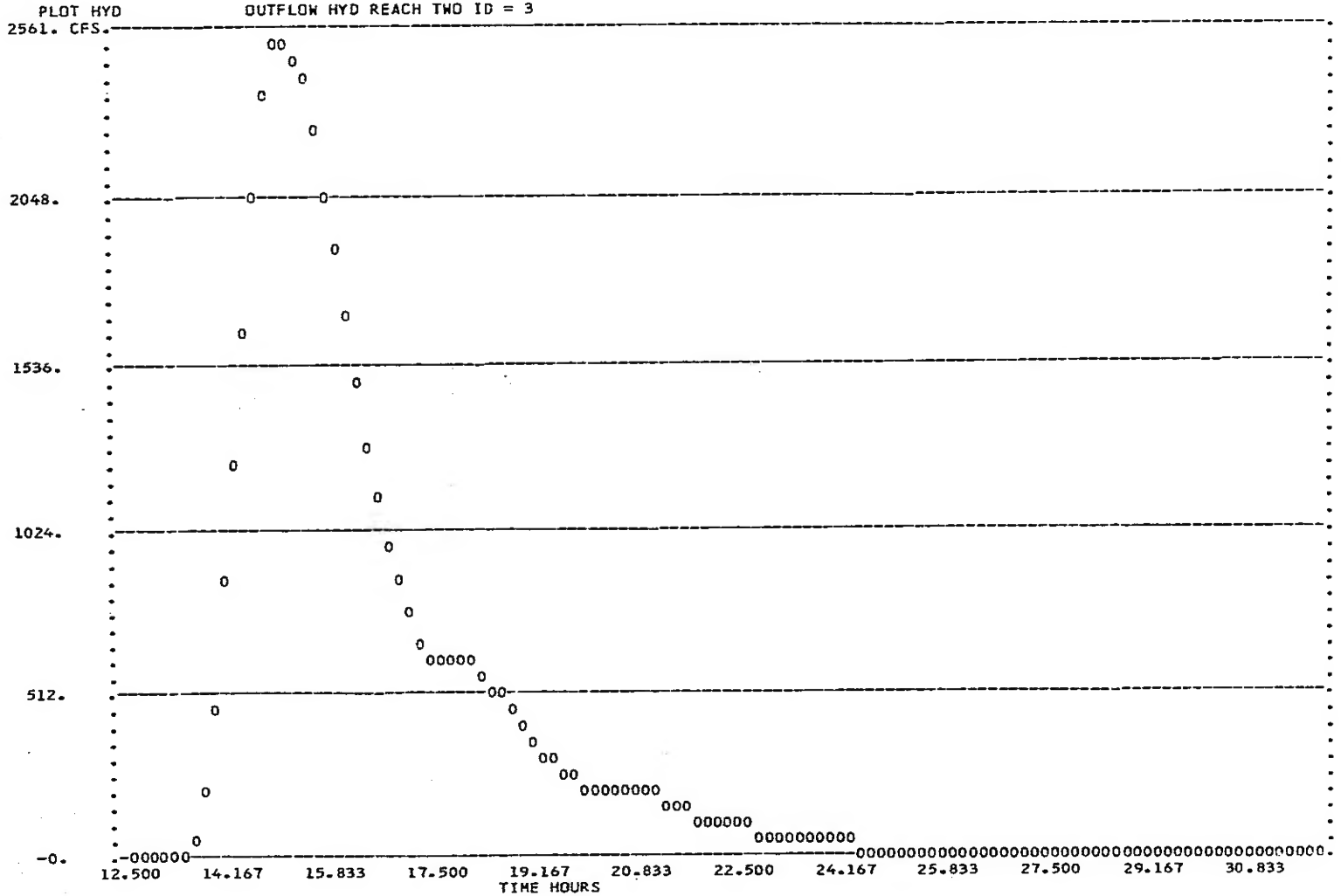
```
ADD HYD          ID=3   HYD NO=2   IDS OF HYDS TO BE ADDED ARE 1 AND 2      *
PRINT HYD        ID=3
```

OUTFLOW HYDROGRAPH REACH 2

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
12.500	0.	17.667	618.	22.833	95.	27.999	17.	33.166	1.
12.667	0.	17.833	628.	23.000	89.	28.166	16.	33.332	1.
12.833	0.	18.000	630.	23.166	83.	28.333	15.	33.499	1.
13.000	0.	18.167	618.	23.333	78.	28.499	15.	33.666	1.
13.167	1.	18.333	593.	23.500	73.	28.666	14.	33.832	1.
13.333	3.	18.500	560.	23.666	68.	28.833	13.	33.999	1.
13.500	11.	18.666	522.	23.833	64.	28.999	13.	34.166	1.
13.667	57.	18.833	479.	23.999	60.	29.166	12.	34.332	1.
13.833	206.	19.000	434.	24.166	56.	29.333	12.	34.499	1.
14.000	507.	19.166	390.	24.333	53.	29.499	11.	34.666	0.
14.167	884.	19.333	350.	24.499	50.	29.666	10.	34.832	0.
14.333	1260.	19.500	314.	24.666	47.	29.832	10.	34.999	0.
14.500	1662.	19.666	282.	24.833	45.	29.999	9.	35.165	0.
14.667	2095.	19.833	259.	24.999	42.	30.166	9.	35.332	0.
14.833	2398.	20.000	253.	25.166	40.	30.332	8.	35.499	0.
15.000	2541.	20.166	249.	25.333	38.	30.499	7.	35.665	0.
15.167	2561.	20.333	246.	25.499	36.	30.666	6.	35.832	0.
15.333	2504.	20.500	243.	25.666	34.	30.832	6.	35.999	0.
15.500	2421.	20.666	237.	25.833	32.	30.999	5.	36.165	0.
15.667	2281.	20.833	229.	25.999	30.	31.166	4.	36.332	0.
15.833	2099.	21.000	218.	26.166	29.	31.332	4.	36.499	0.
16.000	1900.	21.166	205.	26.333	28.	31.499	4.	36.665	0.
16.167	1700.	21.333	192.	26.499	26.	31.666	3.	36.832	0.
16.333	1510.	21.500	177.	26.666	25.	31.832	3.	36.999	0.
16.500	1331.	21.666	163.	26.833	24.	31.999	2.	37.165	0.
16.667	1164.	21.833	151.	26.999	23.	32.166	2.	37.332	0.
16.833	1012.	22.000	140.	27.166	22.	32.332	2.	37.499	0.
17.000	878.	22.166	129.	27.333	21.	32.499	2.	37.665	0.
17.167	769.	22.333	119.	27.499	20.	32.666	2.	37.832	0.
17.333	686.	22.500	110.	27.666	19.	32.832	2.		
17.500	634.	22.666	102.	27.833	18.	32.999	1.		

RUNOFF VOLUME = 4.674 INCHES
PEAK DISCHARGE RATE = 2560.5 CFS

```
* IT MAY BE DESIRABLE TO PLOT ALL HYDROGRAPHS. HOWEVER TO SAVE SPACE IN THIS   *
* EXAMPLE, ONLY A FEW OUTFLOW HYDROGRAPHS ARE PLOTTED.
*
PLOT HYD            OUTFLOW HYD REACH TWO ID = 3
```



```
* THIS COMPLETES THE ROUTING THROUGH THE FIRST REACH. FOR THE REMAINDER OF THE *
* ROUTING, COMMENTS AND KEYWORDS WILL BE BRIEFER.
* VALLEY SECTIONS 5 6 AND 7 ARE USED TO ROUTE THROUGH REACH 3. THE RATING CURVE
* HAS BEEN COMPUTED FOR VS 7 AND IS STORED IN ID 2. ID NUMBERS 1 AND 3 MUST BE
* USED FOR VS-5 AND VS-6.
*
COMPUTE RATING CURVE   ID=1   VS 6   3 SEG   MIN ELEV=502.1 FT
                    MAX ELEV=511 FT   CH SLP=.0018   FP SLP=.00245
                    N=.05 DIST=680   N=.03 DIST=695   N=.05 DIST=1025
                    DIST   ELEV   DIST   ELEV   DIST   ELEV   DIST   ELEV
                      0   511.0   250   508.4   350   507.7   400   507.7
                    450   507.9   550   507.8   650   507.9   653   506.6
                    680   505.5   684   503.8   687   502.1   693   502.8
                    695   504.6   702   505.6   800   505.4   850   507.8
                    950   509.8   1025   511.0
```

RATING CURVE VALLEY SECTION 6.0

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS
502.10	0.0	0.0
502.57	1.1	0.9
503.04	4.3	6.2
503.50	8.3	16.8
503.97	13.0	32.4
504.44	18.4	53.4
504.91	24.8	82.8
505.38	33.3	122.0
505.85	80.8	205.3
506.31	150.3	373.0
506.78	229.4	618.7
507.25	314.4	946.0
507.72	405.6	1303.6
508.19	630.1	1826.8
508.66	925.5	2672.5
509.12	1254.0	3809.6
509.59	1614.6	5249.7
510.06	2007.6	6992.5
510.53	2435.2	9076.7
511.00	2897.5	11559.4

COMPUTE RATING CURVE ID=3 VS 5 3 SEG MIN ELEV=496.6 *

MAX ELEV=506 FT CH SLP=.0018 FP SLP=.00245

N=.05 DIST=314 N=-.03 DIST=326 N=.05 DIST=960

DIST	ELEV	DIST	ELEV	DIST	ELEV	DIST	ELEV
25	506.0	150	503.7	200	502.2	250	501.2
300	502.5	314	500.5	317	497.5	320	496.6
325	496.9	326	500.5	334	501.3	350	502.0
400	503.4	450	503.8	550	503.7	650	504.1
800	505.4	850	504.5	900	505.4	960	506.0

RATING CURVE VALLEY SECTION 5.0

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS
496.60	0.0	0.0
497.09	2.1	2.1
497.59	5.9	9.9
498.08	10.1	23.1
498.58	14.7	41.0
499.07	19.6	63.3
499.57	24.8	90.2
500.06	30.3	121.8
500.56	36.1	159.5
501.05	44.6	215.3
501.55	62.9	287.4
502.04	108.9	403.4
502.54	184.6	592.3
503.03	282.2	887.2
503.52	397.5	1272.9
504.02	583.1	1723.6
504.51	854.7	2526.8
505.01	1182.7	3561.5
505.50	1578.6	4956.2
506.00	2022.1	6825.7

```
COMPUTE TRAVEL TIME   ID=1   REACH 3   3 VS   LENGTH=3330 FT   SLP=.00245      *

                                   TRAVEL TIME TABLE
                                         REACH  3.0

                                   WATER      FLOW      TRAVEL
                                   DEPTH      RATE       TIME
                                   FEET       CFS        HRS
                                    0.45         2.     0.8623
                                    0.96        10.     0.5484
                                    1.45        23.     0.4135
                                    1.92        41.     0.3434
                                    2.37        63.     0.2988
                                    2.80        90.     0.2674
                                    3.22       122.     0.2447
                                    3.58       160.     0.2527
                                    3.99       215.     0.2703
                                    4.32       287.     0.2906
                                    4.69       403.     0.3160
                                    5.10       592.     0.3241
                                    5.57       887.     0.3265
                                    6.03      1273.     0.3205
                                    6.45      1724.     0.3371
                                    6.91      2527.     0.3349
                                    7.40      3561.     0.3331
                                    7.86      4956.     0.3286
                                    8.31      6826.     0.3039
ROUTE              ID=1   HYD NO=102   INFLOW ID=3   DT=.2 HR
*
* IT MAY NOT BE NECESSARY TO PRINT THE COORDINATES OF ALL HYDS. FOR THE
* REMAINDER OF THE EXAMPLE, ONLY REACH OUTFLOW HYDS WILL BE PRINTED. TO PRINT
* ONLY THE RUNOFF VOLUME AND PEAK RATE, A CODE IS USED WITH PRINT HYD.
*
PRINT HYD          ID=1   CODE=1

                                   PARTIAL HYDROGRAPH  102

     RUNOFF VOLUME =      4.672 INCHES
     PEAK DISCHARGE RATE =     2366.2 CFS


* COMPUTE THE HYD FROM AREA 303.
*
COMPUTE HYD        ID=2   HYD NO 303   DT=.1666667 HR   DA=1.108 SQ MI   CN=82
                   HT=80 FT   L=1.7 MI   CODE=-1 (SIGNAL TO USE SAME MASS
                   RAINFALL AS USED IN PREVIOUS HYD)
    SHAPE CONSTANT, N =  2.248
    UNIT PEAK =      253.1CFS

PRINT HYD          ID=2  CODE=1

                                   HYDROGRAPH FROM AREA 303

     RUNOFF VOLUME =      4.131 INCHES
     PEAK DISCHARGE RATE =      673.5 CFS
```

```
* TO OBTAIN THE OUTFLOW FROM REACH 3, ADD HYD  FROM AREA 303 TO ROUTED HYD 102.*
*
ADD HYD              ID=3   HYD NO=3   IDS ADDED ARE 1 AND 2
PRINT HYD            ID=3
```

OUTFLOW HYDROGRAPH REACH 3

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
12.500	0.	18.333	918.	24.166	112.	29.999	24.	35.832	2.
12.667	0.	18.500	883.	24.333	105.	30.166	23.	35.999	2.
12.833	0.	18.666	839.	24.499	100.	30.332	22.	36.165	2.
13.000	0.	18.833	789.	24.666	94.	30.499	20.	36.332	1.
13.167	1.	19.000	736.	24.833	90.	30.666	19.	36.499	1.
13.333	3.	19.166	680.	24.999	86.	30.832	18.	36.665	1.
13.500	10.	19.333	626.	25.166	82.	30.999	17.	36.832	1.
13.667	48.	19.500	574.	25.333	78.	31.166	16.	36.999	1.
13.833	172.	19.666	526.	25.499	74.	31.332	16.	37.165	1.
14.000	398.	19.833	485.	25.666	71.	31.499	15.	37.332	1.
14.167	692.	20.000	464.	25.833	67.	31.666	14.	37.499	1.
14.333	1028.	20.166	449.	25.999	64.	31.832	13.	37.665	1.
14.500	1432.	20.333	438.	26.166	62.	31.999	13.	37.832	0.
14.667	1877.	20.500	429.	26.333	59.	32.166	12.	37.999	0.
14.833	2288.	20.666	419.	26.499	57.	32.332	11.	38.165	0.
15.000	2615.	20.833	406.	26.666	55.	32.499	11.	38.332	0.
15.167	2848.	21.000	391.	26.833	53.	32.666	10.	38.499	0.
15.333	2984.	21.166	374.	26.999	50.	32.832	10.	38.665	0.
15.500	3027.	21.333	355.	27.166	48.	32.999	9.	38.832	0.
15.667	2977.	21.500	335.	27.333	46.	33.166	9.	38.999	0.
15.833	2864.	21.666	315.	27.499	44.	33.332	9.	39.165	0.
16.000	2704.	21.833	294.	27.666	42.	33.499	8.	39.332	0.
16.167	2515.	22.000	273.	27.833	40.	33.666	8.	39.499	0.
16.333	2315.	22.166	253.	27.999	39.	33.832	7.	39.665	0.
16.500	2119.	22.333	235.	28.166	37.	33.999	6.	39.832	0.
16.667	1927.	22.500	217.	28.333	36.	34.166	6.	39.999	0.
16.833	1738.	22.666	200.	28.499	34.	34.332	5.	40.165	0.
17.000	1553.	22.833	186.	28.666	33.	34.499	4.	40.332	0.
17.167	1380.	23.000	173.	28.833	32.	34.666	4.	40.498	0.
17.333	1226.	23.166	161.	28.999	31.	34.832	3.	40.665	0.
17.500	1104.	23.333	151.	29.166	30.	34.999	2.	40.832	0.
17.667	1028.	23.500	142.	29.333	28.	35.165	2.	40.998	0.
17.833	994.	23.666	133.	29.499	27.	35.332	2.	41.165	0.
18.000	970.	23.833	126.	29.666	26.	35.499	2.	41.332	0.
18.167	947.	23.999	118.	29.832	25.	35.665	2.		

RUNOFF VOLUME = 4.509 INCHES
PEAK DISCHARGE RATE = 3026.6 CFS

```
* ROUTE THROUGH REACH 4.
*
COMPUTE RATING CURVE  ID=1   VS=4   3 SEG   MIN ELEV 491.8
                    MAX ELEV=501 FT   CH SLP=.0018   FP SLP=.003
                    N=.05 DIST=1046   N=-.03 DIST=1068   N=.05 DIST=1082
                    DIST   ELEV   DIST   ELEV   DIST   ELEV   DIST   ELEV
                       0   501.0    200   500.3    250   500.3    300   499.9
                     450   499.1    500   500.8    550   498.9    600   499.0
                     700   499.5    800   499.6    850   499.0    900   497.7
                     950   497.6   1000   497.1   1031   497.4   1046   497.2
                    1050   494.5   1056   494.2   1061   491.9   1064   491.8
                    1068   495.7   1072   497.4   1082   501.0
```

RATING CURVE VALLEY SECTION 4.0

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS
491.80	0.0	0.0
492.28	1.6	1.7
492.77	4.1	6.6
493.25	7.3	15.1
493.74	11.2	27.8
494.22	16.0	44.6
494.70	23.3	62.5
495.19	32.0	103.5
495.67	41.2	155.2
496.16	51.2	222.8
496.64	62.1	305.1
497.13	73.9	403.4
497.61	115.2	553.8
498.09	200.0	813.9
498.58	296.4	1195.6
499.06	408.8	1598.0
499.55	612.3	2078.4
500.03	949.7	3122.3
500.51	1350.0	4498.2
501.00	1837.5	6404.5

COMPUTE RATING CURVE ID=2 VS=3 3 SEG MIN EVEL=486.2
MAX ELEV=499 CH SLP=.0018 FP SLP=.0036
N=.05 DIST=520 N=-.03 DIST=547 N=.05 DIST=1200

DIST	ELEV	DIST	ELEV	DIST	ELEV	DIST	ELEV
297	499.0	350	496.4	378	494.7	400	491.7
450	491.8	500	492.2	520	491.2	529	486.6
536	486.2	540	490.4	547	492.7	600	495.9
650	496.1	729	496.7	900	496.6	1000	497.0
1150	498.3	1210	499.0				

RATING CURVE VALLEY SECTION 3.0

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS
486.20	0.0	0.0
486.87	3.6	4.4
487.55	9.8	20.6
488.22	17.3	48.2
488.89	26.1	88.8
489.57	36.2	144.3
490.24	47.6	217.0
490.92	60.7	300.6
491.59	77.3	419.1
492.26	143.6	626.6
492.94	247.2	1054.5
493.61	360.4	1720.5
494.28	484.4	2616.8
494.96	619.5	3756.2
495.63	768.9	5163.4
496.30	949.8	6844.7
496.98	1271.9	9049.4
497.65	1746.6	12457.3
498.32	2283.0	17061.9
499.00	2873.8	23295.3

```
COMPUTE TRAVEL TIME   ID=1   REACH 4   3 VS   L=3415   SLP=.003                *
```

TRAVEL TIME TABLE
REACH 4.0

WATER DEPTH FEET	FLOW RATE CFS	TRAVEL TIME HRS
0.38	2.	0.8777
0.84	7.	0.6140
1.25	15.	0.4719
1.69	28.	0.3899
2.14	45.	0.3386
2.54	62.	0.3192
3.15	104.	0.2683
3.75	155.	0.2335
4.32	223.	0.2076
4.87	305.	0.2004
5.36	403.	0.2022
5.82	554.	0.2311
6.32	814.	0.2513
6.83	1196.	0.2491
7.28	1598.	0.2532
7.69	2078.	0.2625
8.27	3122.	0.2570
8.86	4498.	0.2458
9.47	6405.	0.2302

```
ROUTE                ID=1   HYD NO=103   INFLOW ID=3   DT=.2
PRINT HYD            ID=1   CODE=1
```

PARTIAL HYDROGRAPH 103

RUNOFF VOLUME = 4.508 INCHES
PEAK DISCHARGE RATE = 2904.3 CFS

```
* COMPUTE THE HYD FROM AREA 304.
*
COMPUTE HYD          ID=2   HYD NO=304   DT=.25   DA=.807   CN=82
                     HT=80   L=1.70
                     RAINFALL = 0 0 .45 .59 .87 1.7 2.72 3.35 3.98 4.65 4.8 4.98
                     5.07 5.07 5.07 5.11 5.21 5.34 5.34 5.35 5.45 5.77 5.88 5.95
                     6.06 6.1 6.1 6.1 6.1 6.11 6.11 6.11 6.12 6.12 6.12 6.13
                     6.13 6.13 6.13 6.14 6.17 6.17 6.17 6.17 6.18 6.18 6.19
    SHAPE CONSTANT, N =  2.156
    UNIT PEAK =       192.9CFS

PRINT HYD            ID=2   CODE=1
```

HYDROGRAPH FROM AREA 304

RUNOFF VOLUME = 4.111 INCHES
PEAK DISCHARGE RATE = 504.5 CFS

```
* ADD THE HYD FROM AREA 304 TO THE PARTIAL HYD 103 TO OBTAIN THE OUTFLOW FROM  *
* REACH 4.
*
ADC HYD              ID=3    HYD NO=4    ICS ADDED ARE 1 AND 2
PRINT HYD            ID=3
```

OUTFLOW HYDROGRAPH REACH 4

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
12.500	0.	18.500	1149.	24.500	141.	30.500	30.	36.500	2.
12.700	0.	18.700	1097.	24.700	132.	30.700	29.	36.700	2.
12.900	0.	18.900	1036.	24.900	124.	30.900	27.	36.900	2.
13.100	0.	19.100	968.	25.100	117.	31.100	26.	37.100	2.
13.300	3.	19.300	896.	25.300	111.	31.300	24.	37.300	2.
13.500	10.	19.500	820.	25.500	105.	31.500	23.	37.500	2.
13.700	59.	19.700	746.	25.700	99.	31.700	22.	37.700	1.
13.900	215.	19.900	679.	25.900	94.	31.900	20.	37.900	1.
14.100	523.	20.100	626.	26.100	89.	32.100	19.	38.100	1.
14.300	873.	20.300	586.	26.300	85.	32.300	17.	38.300	0.
14.500	1277.	20.500	555.	26.500	81.	32.500	16.	38.500	0.
14.700	1788.	20.700	529.	26.700	77.	32.700	14.	38.700	0.
14.900	2291.	20.900	506.	26.900	73.	32.900	13.	38.900	0.
15.100	2727.	21.100	481.	27.100	70.	33.100	12.	39.100	0.
15.300	3072.	21.300	454.	27.300	66.	33.300	12.	39.300	0.
15.500	3290.	21.500	426.	27.500	63.	33.500	11.	39.500	0.
15.700	3351.	21.700	397.	27.700	60.	33.700	10.	39.700	0.
15.900	3285.	21.900	367.	27.900	57.	33.900	10.	39.900	0.
16.100	3131.	22.100	338.	28.100	54.	34.100	9.	40.100	0.
16.300	2920.	22.300	311.	28.300	51.	34.300	8.	40.300	0.
16.500	2685.	22.500	288.	28.500	49.	34.500	7.	40.500	0.
16.700	2452.	22.700	264.	28.700	47.	34.700	6.	40.700	0.
16.900	2221.	22.900	242.	28.900	45.	34.900	6.	40.900	0.
17.100	1988.	23.100	224.	29.100	43.	35.100	5.	41.100	0.
17.300	1757.	23.300	208.	29.300	41.	35.300	4.	41.300	0.
17.500	1547.	23.500	194.	29.500	39.	35.500	4.	41.500	0.
17.700	1400.	23.700	181.	29.700	37.	35.700	4.	41.700	0.
17.900	1302.	23.900	170.	29.900	35.	35.900	3.	41.900	0.
18.100	1240.	24.100	160.	30.100	34.	36.100	3.		
18.300	1192.	24.300	150.	30.300	32.	36.300	2.		

RUNOFF VOLUME = 4.436 INCHES
PEAK DISCHARGE RATE = 3351.1 CFS

```
* ROUTE THROUGH REACH 5.
*
COMPUTE RATING CURVE    ID=1  VS 2   3 SEG  MIN ELEV=481.8
                    MAX ELEV 493    CH SLP=.0018    FP SLP=.0036
                    N=.05 DIST=387    N=-.03 DIST=405    N=.05 DIST=558
                    DIST   ELEV    DIST   ELEV    DIST   ELEV    DIST   ELEV
                    131    493.0   150    492.0   189    490.8   250    490.6
                    258    489.9   270    486.8   300    485.5   350    485.9
                    387    485.5   392    483.3   397    482.1   400    481.8
                    405    485.4   427    488.6   450    490.1   550    492.9
                    558    493.0
```

RATING CURVE VALLEY SECTION 2.0

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS
481.80	0.0	0.0
482.39	1.7	1.8
482.98	5.7	9.4
483.57	11.4	25.6
484.16	18.6	52.2
484.75	27.0	90.1
485.34	36.7	141.1
485.93	69.9	237.2
486.51	144.9	461.2
487.10	229.5	818.5
487.69	318.5	1316.9
488.28	411.3	1958.3
488.87	508.1	2749.5
489.46	611.1	3713.2
490.05	720.9	4861.2
490.64	842.5	5879.6
491.23	1013.0	6693.6
491.82	1210.7	8589.4
492.41	1430.9	11066.8
493.00	1670.6	14198.7

COMPUTE RATING CURVE ID=3 VS=1 3 SEG MIN ELEV=474.1 MAX ELEV=488
CH SLP=.0018 FP SLP =.0028 N=.05 DIST= 232
N=-.03 DIST= 250 N=.05 DIST= 627

DIST	ELEV	DIST	ELEV	DIST	ELEV	DIST	ELEV
61	488.0	100	486.6	171	481.0	215	480.8
232	478.6	236	474.2	242	474.1	247	477.9
250	478.9	300	482.9	350	484.2	400	484.2
627	488.0						

RATING CURVE VALLEY SECTION 1.0

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS
474.10	0.0	0.0
474.83	4.6	7.0
475.56	10.7	25.4
476.29	18.0	55.1
477.03	26.5	97.4
477.76	36.2	154.2
478.49	47.4	220.9
479.22	62.4	331.5
479.95	87.4	507.9
480.68	123.2	756.2
481.41	192.1	1108.7
482.15	283.5	1659.7
482.88	388.3	2411.3
483.61	513.1	3352.4
484.34	672.5	4507.0
485.07	896.5	6323.3
485.80	1159.2	8782.5
486.53	1460.7	12141.1
487.27	1804.2	16663.6
488.00	2194.6	23601.4

```
COMPUTE TRAVEL TIME   ID=1   REACH 5   3 VS   L=3310   SLP=.003
```

TRAVEL TIME TABLE
REACH 5.0

WATER DEPTH FEET	FLOW RATE CFS	TRAVEL TIME HRS
0.35	2.	0.7488
0.96	9.	0.5416
1.57	26.	0.3996
2.19	52.	0.3173
2.82	90.	0.2666
3.45	141.	0.2309
4.28	237.	0.2201
5.30	461.	0.2103
6.13	818.	0.2078
6.83	1317.	0.1948
7.47	1958.	0.1768
8.09	2750.	0.1607
8.71	3713.	0.1476
9.31	4861.	0.1371
9.78	5880.	0.1319
10.18	6694.	0.1320
10.77	8589.	0.1268
11.33	11067.	0.1204
11.89	14199.	0.1130

```
ROUTE              ID=1   HYD NO=104   INFLOW ID=3   DT=.2
PRINT HYD          ID=1   CODE=1
```

PARTIAL HYDROGRAPH 104

RUNOFF VOLUME = 4.436 INCHES
PEAK DISCHARGE RATE = 3318.5 CFS

```
COMPUTE HYD        ID=2   HYD NO=305   DT=.333333   DA=1.875   CN=82
                   K=-2   TP=-1.2
                   RAINFALL 0 0 .29 .61 1.12 2.27 3.24 4.21 4.76 4.94 5.03
                   5.03 5.07 5.31 5.43 5.44 5.5 5.7 5.7 5.71 5.71 5.72 5.7
                   5.73 5.78 5.79 5.8 5.8 5.81 5.83 5.84 5.85 5.85 5.85 5.
                   5.87
   SHAPE CONSTANT, N = 2.254
   UNIT PEAK =      334.3CFS

PRINT HYD          ID=2   CODE=1
```

HYDROGRAPH FROM AREA 305

RUNOFF VOLUME = 3.837 INCHES
PEAK DISCHARGE RATE = 936.7 CFS

```
* ADD THE HYD FROM AREA 305 TO THE PARTIAL HYD 104.
*
ADD HYD              ID=3   HYD NO=105   IDS ADDED ARE 1 AND 2
PRINT HYD            ID=3   CODE=1

                                   PARTIAL HYDROGRAPH  105

     RUNOFF VOLUME =       4.259 INCHES
     PEAK DISCHARGE RATE =      4244.3 CFS


* THE HYD FROM AREA 306 WAS MEASURED, SO STORE HYD IS USED TO STORE IT IN THE
* PROGRAM.
*
STORE HYD            ID=1   HYD NO=306   DT=.25   DA=.483
                     FLOW RATE CFS= 0 0 0 0 45 280 560 638 570 370 258 170 97 72
                     64 61 80 70 59 54 52 51 50 46 44 40 38 33 30 27 25 24 23 22
                     21 20 20 19 18 16 16 15 13 11 10 9 8 7 6 5 5 5 4 4 3 3 3 2
                     2 2 1 1
* ROUTE THE HYD FROM AREA 306 THROUGH REACH 6.
*
COMPUTE RATING CURVE  ID=1   VS=21   3 SEG   MIN ELEV=506.0   MAX ELEV=514
                     CH SLP= .006  FP SLP= .0075      N=.05 DIST= 300
                     N=-.03 DIST= 310      N=.05 DIST= 570
                     DIST   ELEV   DIST   ELEV   DIST   ELEV   DIST   ELEV
                       0   514.0   300   508.0   302   506.0   307   506.0
                     310   508.0   380   510.0   520   512.0   570   514.0

                                RATING CURVE VALLEY SECTION 21.0
                                    WATER      FLOW       FLOW
                                  SURFACE      AREA       RATE
                                   ELEV       SQ FT      CFS
                                  506.00        0.0        0.0
                                  506.42        2.3        4.7
                                  506.84        5.1       15.7
                                  507.26        8.3       32.6
                                  507.68       12.0       55.7
                                  508.10       16.5       87.5
                                  508.53       32.0      146.0
                                  508.95       62.5      250.6
                                  509.37      108.1      420.9
                                  509.79      168.8      675.2
                                  510.21      245.2     1018.8
                                  510.63      342.2     1482.0
                                  511.05      460.4     2102.0
                                  511.47      599.9     2902.4
                                  511.89      760.6     3907.9
                                  512.31      940.3     5214.1
                                  512.73     1133.7     6796.0
                                  513.16     1340.3     8649.2
                                  513.58     1560.2    10795.8
                                  514.00     1793.3    13260.7
```

COMPUTE RATING CURVE ID=2 VS=20 3 SEG MIN ELEV=482.0 MAX ELEV=492 *
CH SLP=.006 FP SLP=.0075 N=.05 DIST= 175
N=-.03 DIST=205 N=.05 DIST=450

DIST	ELEV	DIST	ELEV	DIST	ELEV	DIST	ELEV
0	492.0	100	490.0	175	484.0	188	482.0
190	482.0	205	484.0	250	486.0	275	488.0
310	490.0	450	492.0				

RATING CURVE VALLEY SECTION 20.0

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS
482.00	0.0	0.0
482.53	3.0	5.5
483.05	9.9	27.8
483.58	20.6	76.1
484.10	35.3	164.8
484.63	57.9	329.7
485.16	90.1	573.6
485.68	132.0	917.0
486.21	183.4	1384.8
486.74	242.3	1999.6
487.26	308.0	2777.3
487.79	380.7	3744.8
488.31	460.5	4921.7
488.84	548.5	6356.6
489.37	644.8	8115.9
489.89	749.5	10274.9
490.42	870.3	12413.3
490.94	1023.7	15306.2
491.47	1210.4	19275.9
492.00	1430.4	24694.0

COMPUTE TRAVEL TIME ID=2 REACH 6 2 VS L=4080 SLP=.0075

TRAVEL TIME TABLE
REACH 6.0

WATER DEPTH FEET	FLOW RATE CFS	TRAVEL TIME HRS
0.44	5.	0.5893
0.80	16.	0.4055
1.18	33.	0.3346
1.52	56.	0.2852
1.88	88.	0.2525
2.26	146.	0.2491
2.66	251.	0.2478
3.10	421.	0.2397
3.55	675.	0.2277
4.00	1019.	0.2161
4.46	1482.	0.2045
4.93	2102.	0.1918
5.40	2902.	0.1791
5.88	3908.	0.1671
6.37	5214.	0.1542
6.85	6796.	0.1423
7.33	8649.	0.1318
7.80	10796.	0.1228
8.28	13261.	0.1157

ROUTE ID=2 HYD NO=106 INFLOW ID=1 DT=.2
PRINT HYD ID=2 CODE=1

PARTIAL HYDROGRAPH 106

RUNOFF VOLUME = 3.364 INCHES
PEAK DISCHARGE RATE = 574.6 CFS

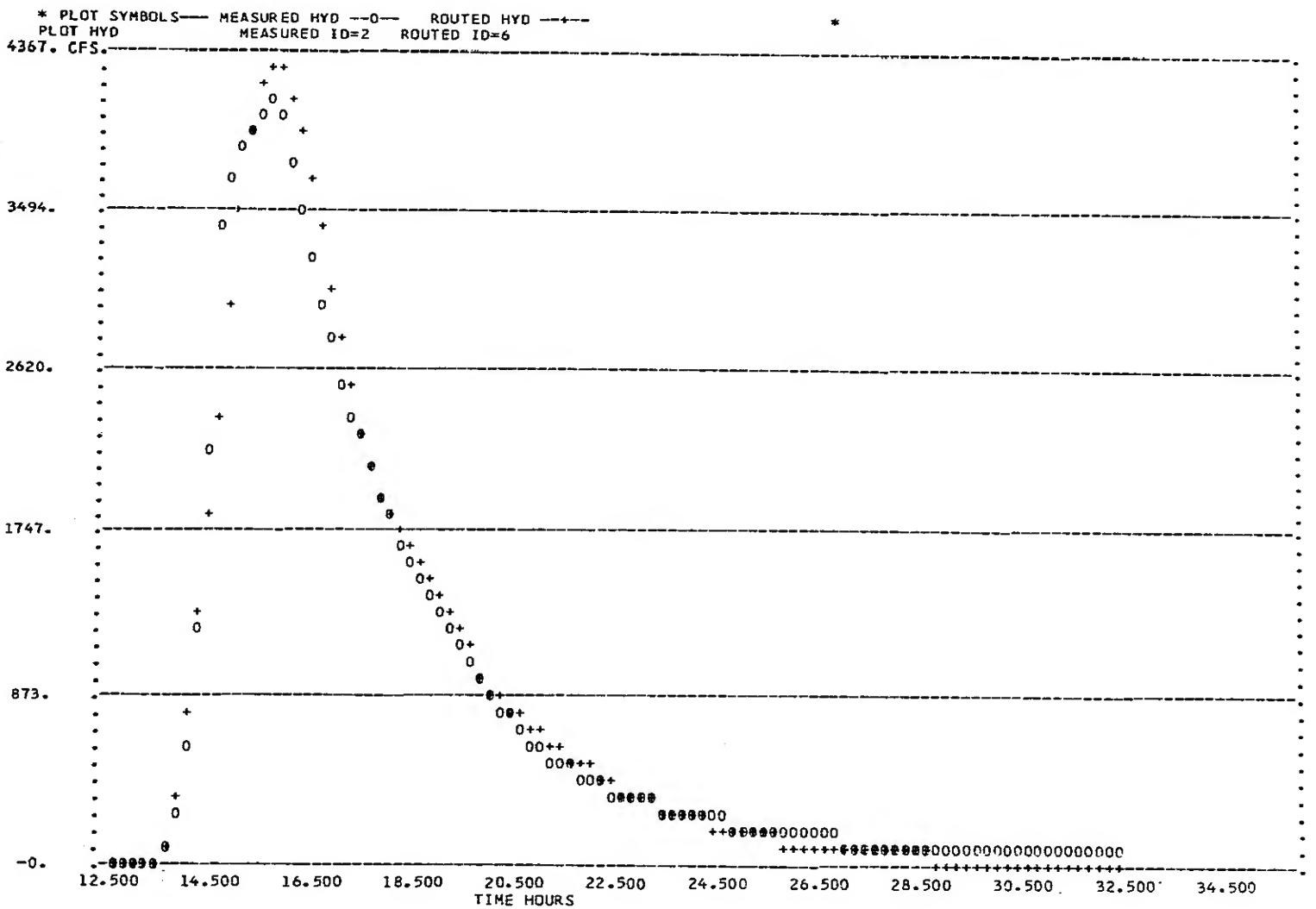
```
* TO OBTAIN THE OUTFLOW HYD FROM REACH 5, ADD PARTIAL HYDS 106 AND 105.        *
*
ADD HYD              ID=6   HYD NO=5   IDS ADDED ARE 3 AND 2
* SINCE THE OUTFLOW HYDROGRAPH FROM REACH 5 WILL BE USED FOR COMPARISON IN THE
* SECOND ROUTING, THE PUNCH HYD COMMAND IS USED. THIS IS NECESSARY BECAUSE THE
* PUNCH CODE DOES NOT PUNCH FOR THE ADD HYD COMMAND.
PUNCH HYD            ID=6
PRINT HYD            ID=6
```

OUTFLOW HYDROGRAPH REACH 5

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
12.500	0.	20.300	889.	28.100	103.	35.900	16.	43.700	1.
12.700	0.	20.500	833.	28.300	98.	36.100	15.	43.900	1.
12.900	0.	20.700	788.	28.500	94.	36.300	15.	44.100	1.
13.100	0.	20.900	749.	28.700	89.	36.500	14.	44.300	1.
13.300	3.	21.100	714.	28.900	85.	36.700	13.	44.500	1.
13.500	15.	21.300	678.	29.100	81.	36.900	13.	44.700	1.
13.700	106.	21.500	641.	29.300	78.	37.100	12.	44.900	1.
13.900	378.	21.700	604.	29.500	75.	37.300	12.	45.100	0.
14.100	829.	21.900	568.	29.700	72.	37.500	11.	45.300	0.
14.300	1349.	22.100	532.	29.900	69.	37.700	11.	45.500	0.
14.500	1855.	22.300	497.	30.100	67.	37.900	10.	45.700	0.
14.700	2403.	22.500	466.	30.300	64.	38.100	10.	45.900	0.
14.900	2983.	22.700	436.	30.500	61.	38.300	9.	46.100	0.
15.100	3537.	22.900	407.	30.700	59.	38.500	9.	46.300	0.
15.300	3968.	23.100	379.	30.900	56.	38.700	7.	46.500	0.
15.500	4260.	23.300	354.	31.100	54.	38.900	7.	46.700	0.
15.700	4367.	23.500	331.	31.300	52.	39.100	7.	46.900	0.
15.900	4337.	23.700	312.	31.500	49.	39.300	7.	47.100	0.
16.100	4181.	23.900	294.	31.700	47.	39.500	6.	47.300	0.
16.300	3950.	24.100	279.	31.900	45.	39.700	6.	47.500	0.
16.500	3684.	24.300	265.	32.100	42.	39.900	6.	47.700	0.
16.700	3415.	24.500	251.	32.300	40.	40.100	6.	47.900	0.
16.900	3143.	24.700	237.	32.500	38.	40.300	6.	48.100	0.
17.100	2880.	24.900	223.	32.700	36.	40.500	5.	48.299	0.
17.300	2611.	25.100	211.	32.900	35.	40.700	5.	48.499	0.
17.500	2353.	25.300	200.	33.100	33.	40.900	5.	48.699	0.
17.700	2137.	25.500	190.	33.300	31.	41.100	5.	48.899	0.
17.900	1978.	25.700	181.	33.500	30.	41.300	4.	49.099	0.
18.100	1869.	25.900	172.	33.700	29.	41.500	4.	49.299	0.
18.300	1783.	26.100	164.	33.900	28.	41.700	3.	49.499	0.
18.500	1707.	26.300	156.	34.100	26.	41.900	3.	49.699	0.
18.700	1628.	26.500	148.	34.300	25.	42.100	2.	49.899	0.
18.900	1541.	26.700	141.	34.500	24.	42.300	2.	50.099	0.
19.100	1446.	26.900	135.	34.700	22.	42.500	1.	50.299	0.
19.300	1347.	27.100	129.	34.900	21.	42.700	1.	50.499	0.
19.500	1244.	27.300	123.	35.100	20.	42.900	1.	50.699	0.
19.700	1141.	27.500	118.	35.300	19.	43.100	1.	50.899	0.
19.900	1044.	27.700	112.	35.500	18.	43.300	1.	51.099	0.
20.100	959.	27.900	107.	35.700	17.	43.500	1.		

RUNOFF VOLUME = 4.196 INCHES
PEAK DISCHARGE RATE = 4367.5 CFS

```
* THE SEDIMENT YIELD COMMAND IS USED TO COMPUTE THE SEDIMENT YIELD PRODUCED BY *
* THE ROUTED FLOOD.
*
SEDIMENT YIELD      ID=6   SOIL=.34   CROP=.16   CP=.4   LS=.3
     SEDIMENT YIELD =     4116.9 TONS
* THE MEASURED SEDIMENT YIELD FOR THIS FLOOD WAS 3916 TONS.
* THE ROUTED OUTFLOW HYDROGRAPH CAN BE COMPARED WITH THE MEASURED HYDROGRAPH BY
* PLOTTING AND ERROR ANALYSIS
*
* STORE THE MEASURED HYDROGRAPH
*
STORE HYD           ID=2   HYD NO=5   DT=.1666667   DA=6.84
                    FLOW RATE = 0 0 0 0 0 0 0 0 100 220 400 790 1350 2200 3400
                    3650 3800 3920 4020 4100 4200 4100 3910 3700 3500 3280 3070
                    2860 2700 2550 2400 2290 2150 2000 1900 1800 1700 1620 1530
                    1460 1380 1300 1210 1150 1090 1000 970 900 820 800 750 700
                    670 620 600 570 530 510 500 490 470 430 400 390 380 370 350
                    340 330 320 310 300 300 290 270 260 240 220 210 210 200 200
                    200 190 190 190 180 180 170 170 160 160 160 150 150 150 150
                    150 150 140 140 140 140 140 140 140 140 130 120 120 120 120 120
                    120 110 110 110 110 110 110 110 100 100 90
```


* PLOT SYMBOLS—— MEASURED HYD --0-- ROUTED HYD --+--
PLOT HYD MEASURED ID=2 ROUTED ID=6
4367. CFS.
3494.
2620.
1747.
873.
-0.
12.500
14.500
16.500
18.500
20.500
22.500
24.500
26.500
28.500
30.500
32.500
34.500
TIME HOURS

* THE ERROR ANALYSIS COMMAND IS USED TO COMPUTE THE MAGNITUDE OF THE ERROR *
*
ERROR ANALYSIS MEASURED ID=2 (FLOW ONE) ROUTED ID=6 (FLOW TWO)

TIME HRS	FLOW 1 CFS	FLOW 2 CFS	ERROR CFS
12.500	0.	0.	0.
12.700	0.	0.	-0.
12.900	0.	0.	-0.
13.100	0.	0.	-0.
13.300	0.	3.	-3.
13.500	0.	15.	-15.
13.700	124.	106.	18.
13.900	292.	378.	-86.
14.100	634.	829.	-195.
14.300	1238.	1349.	-111.
14.500	2200.	1855.	345.
14.700	3450.	2403.	1047.
14.900	3710.	2983.	727.
15.100	3872.	3537.	335.
15.300	4000.	3968.	32.
15.500	4100.	4260.	-160.
15.700	4180.	4367.	-187.
15.900	4024.	4337.	-313.
16.100	3784.	4181.	-397.
16.300	3540.	3950.	-410.
16.500	3280.	3684.	-404.
16.700	3028.	3415.	-387.
16.900	2796.	3143.	-347.
17.100	2610.	2880.	-270.
17.300	2430.	2611.	-181.
17.500	2290.	2353.	-63.
17.700	2120.	2137.	-17.
17.900	1960.	1978.	-18.
18.100	1840.	1869.	-29.
18.300	1720.	1783.	-63.
18.500	1620.	1707.	-87.
18.700	1516.	1628.	-112.
18.900	1428.	1541.	-113.
19.100	1332.	1446.	-114.
19.300	1228.	1347.	-119.
19.500	1150.	1244.	-94.
19.700	1072.	1141.	-69.
19.900	988.	1044.	-56.
20.100	928.	959.	-31.
20.300	836.	889.	-53.
20.500	800.	833.	-33.
20.700	740.	788.	-48.
20.900	688.	749.	-61.
21.100	640.	714.	-74.
21.300	604.	678.	-74.
21.500	570.	641.	-71.
21.700	526.	604.	-78.
21.900	506.	568.	-62.
22.100	494.	532.	-38.
22.300	474.	497.	-23.
22.500	430.	466.	-36.
22.700	398.	436.	-38.
22.900	386.	407.	-21.

23.100	374.	379.	-5.
23.300	354.	354.	0.
23.500	340.	331.	9.
23.700	328.	312.	16.
23.900	316.	294.	22.
24.100	304.	279.	25.
24.300	300.	265.	35.
24.500	290.	251.	39.
24.700	268.	237.	31.
24.900	252.	223.	29.
25.100	228.	211.	17.
25.300	212.	200.	12.
25.500	210.	190.	20.
25.700	200.	181.	19.
25.900	200.	172.	28.
26.100	194.	164.	30.
26.300	190.	156.	34.
26.500	190.	148.	42.
26.700	180.	141.	39.
26.900	176.	135.	41.
27.100	170.	129.	41.
27.300	162.	123.	39.
27.500	160.	118.	42.
27.700	158.	112.	46.
27.900	150.	107.	43.
28.100	150.	103.	47.
28.300	150.	98.	52.
28.500	150.	94.	56.
28.700	148.	89.	59.
28.900	140.	85.	55.
29.100	140.	81.	59.
29.300	140.	78.	62.
29.500	140.	75.	65.
29.700	140.	72.	68.
29.900	136.	69.	67.
30.100	124.	67.	57.
30.300	120.	64.	56.
30.500	120.	61.	59.
30.700	120.	59.	61.
30.900	120.	56.	64.
31.100	114.	54.	60.
31.300	110.	52.	58.
31.500	110.	49.	61.
31.700	110.	47.	63.
31.900	110.	45.	65.
32.100	110.	42.	68.
32.300	102.	40.	62.
32.500	100.	38.	62.

ERROR STANDARD DEVIATION = 177.294
PEAK DISCHARGE ERROR = 3.99 PERCENT

```
* THIS COMPLETES THE ROUTING FOR THE WATERSHED IN ITS PRESENT CONDITION.       *
* NEXT ASSUME FLOOD DETENTION RESERVOIRS ARE CONSTRUCTED TO CONTROL THE RUNOFF
* FROM AREAS 301 AND 306. TO EVALUATE THE EFFECTS OF THESE RESERVOIRS ON THE
* FLOOD HYDROGRAPH THE FLOOD OF MARCH 29, 1965 IS ROUTED THROUGH THE WATERSHED
* WITH THE RESERVOIRS INSTALLED. SINCE THE PUNCH CODE WAS USED FOR THE FIRST
* ROUTING, ALL CARDS FOR THE SECOND ROUTING WERE PUNCHED BY THE COMPUTER.
* HOWEVER, ROUTE RESERVOIR COMMANDS MUST BE MANUALLY PUNCHED AND PLACED IN THE
* PROGRAM TO ROUTE THROUGH THE PROPOSED RESERVOIRS. ALSO SOME OF THE COMPUTER
* PUNCHED COMMENT CARDS ARE CHANGED OR DELETED.
* THE FIRST STEP IS TO STORE THE HYD FROM AREA 301. NOTICE THE ID NUMBER IS
* CHANGED FROM 1 TO 5 SO THE RESERVOIR OUTFLOW CAN BE STORED IN ID 1 TO MAKE IT
* COMPATABLE WITH THE STORE TRAVEL TIME AND ROUTE COMMANDS FOR REACH 2.
*
RECALL HYD          ID=5    HYD NO=301    DT= 0.166667 HRS    DA=    1.734 SQ MI
                    PEAK=  2360.CFS       RO= 4.933 INCHES    NO PTS=105   FLOW RATE
                        0.      0.      0.      0.      0.      0.     20.
                       90.    220.   1025.   1420.   1380.   2085.   2260.
                     2360.   2110.   1885.   1890.   1760.   1560.   1350.
                     1150.   1000.    860.    690.    560.    460.    400.
                      370.    365.    380.    400.    415.    395.    370.
                      330.    300.    270.    235.    200.    175.    160.
                      140.    130.    120.    110.    110.    110.    110.
                      110.    100.    100.     90.     80.     70.     65.
                       60.     50.     47.     44.     41.     38.     35.
                       33.     31.     29.     27.     25.     23.     22.
                       20.     18.     17.     16.     15.     14.     13.
                       12.     11.     10.     10.      9.      9.      8.
                        8.      7.      7.      6.      6.      6.      5.
                        5.      4.      4.      4.      4.      4.      3.
                        3.      3.      3.      2.      2.      2.      1.
```

```
* THE ROUTE RESERVOIR COMMAND IS USED TO ROUTE HYD 301 THROUGH RESERVOIR 502.  *
*
ROUTE RESERVOIR      ID=1   HYD NO=501   INFLOW ID=5  REMAINING
                     DATA DEFINE RESERVOIR OUTFLOW STORAGE RELATIONSHIP
                     OUTFLOW(CFS)   STORAGE(AC FT)
                            0             50
                           22            533
                          200            555
                         1000            601
                         2000            648
                         3000            694
*
PRINT HYD            ID=1
```

OUTFLOW HYDROGRAPH RESERVOIR 501

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
12.500	0.	17.500	17.	22.500	20.	27.499	20.	32.499	20.
12.667	0.	17.667	17.	22.666	20.	27.666	20.	32.666	20.
12.833	0.	17.833	18.	22.833	20.	27.833	20.	32.832	20.
13.000	0.	18.000	18.	23.000	20.	27.999	20.	32.999	19.
13.167	0.	18.167	18.	23.166	20.	28.166	20.	33.166	19.
13.333	0.	18.333	18.	23.333	20.	28.333	20.	33.332	19.
13.500	0.	18.500	18.	23.500	20.	28.499	20.	33.499	19.
13.667	0.	18.667	19.	23.666	20.	28.666	20.	33.666	19.
13.833	0.	18.833	19.	23.833	20.	28.833	20.	33.832	19.
14.000	1.	19.000	19.	24.000	20.	28.999	20.	33.999	19.
14.167	1.	19.166	19.	24.166	20.	29.166	20.	34.166	19.
14.333	2.	19.333	19.	24.333	20.	29.333	20.	34.332	19.
14.500	3.	19.500	19.	24.499	20.	29.499	20.	34.499	19.
14.667	5.	19.666	19.	24.666	20.	29.666	20.	34.666	19.
14.833	6.	19.833	19.	24.833	20.	29.832	20.	34.832	19.
15.000	7.	20.000	19.	24.999	20.	29.999	20.	34.999	19.
15.167	9.	20.166	19.	25.166	20.	30.166	20.	35.165	19.
15.333	10.	20.333	19.	25.333	20.	30.332	20.	35.332	19.
15.500	11.	20.500	20.	25.499	20.	30.499	20.	35.499	19.
15.667	12.	20.666	20.	25.666	20.	30.666	20.	35.665	19.
15.833	13.	20.833	20.	25.833	20.	30.832	20.	35.832	19.
16.000	14.	21.000	20.	25.999	20.	30.999	20.	35.999	19.
16.167	14.	21.166	20.	26.166	20.	31.166	20.	36.165	19.
16.333	15.	21.333	20.	26.333	20.	31.332	20.	36.332	19.
16.500	15.	21.500	20.	26.499	20.	31.499	20.	36.499	19.
16.667	16.	21.666	20.	26.666	20.	31.666	20.	36.665	19.
16.833	16.	21.833	20.	26.833	20.	31.832	20.	36.832	19.
17.000	16.	22.000	20.	26.999	20.	31.999	20.	36.999	19.
17.167	17.	22.166	20.	27.166	20.	32.166	20.	37.165	19.
17.333	17.	22.333	20.	27.333	20.	32.332	20.	37.332	19.

RUNOFF VOLUME = 0.382 INCHES
PEAK DISCHARGE RATE = 20.0 CFS

```
* NEXT ROUTE THE OUTFLOW HYD FROM RESERVOIR 501 THROUGH REACH 2.                *
* BEFORE ROUTING THE TRAVEL TIME - DEPTH - FLOW RELATIONSHIP MUST BE COMPUTED
* FOR THE REACH.
*
STORE TRAVEL TIME   ID=2    REACH NO=  2.0 LENGTH=    3400. FT
                    SLOPE=0.002900FT/FT
                    DEPTH(FT)      FLOW(CFS)      TIME(HRS)
                       0.30              2.          0.832
                       0.68              6.          0.597
                       1.07             16.          0.498
                       1.58             38.          0.472
                       2.18             86.          0.390
                       2.75            153.          0.338
                       3.28            252.          0.343
                       3.66            371.          0.364
                       4.02            545.          0.359
                       4.45            810.          0.359
                       4.78           1064.          0.360
                       5.13           1431.          0.363
                       5.50           1980.          0.353
                       5.86           2672.          0.341
                       6.29           3670.          0.336
                       6.67           4853.          0.332
                       6.98           6225.          0.307
                       7.29           7793.          0.286
                       7.60           9613.          0.267
ROUTE               ID=2    HYD NO=101      INFLOW ID=1          DT=0.200000HRS
PRINT HYD           ID=2    CODE=1

                                  PARTIAL HYDROGRAPH  101


     RUNOFF VOLUME =      0.411 INCHES
     PEAK DISCHARGE RATE =       20.0 CFS
```

TO OBTAIN THE OUTFLOW HYD FROM REACH 2 THE HYD FROM AREA 302 MUST BE COMPUTED*
AND ADDED TO THE ROUTED HYD 101.

*ECALL HYD ID=1 HYD NO=302 DT= 0.166667 HRS DA= 0.837 SQ MI
PEAK= 572.CFS RO= 4.124 INCHES NO PTS=154
FLOW RATES

0.	0.	0.	0.	1.	2.	9.
36.	89.	169.	254.	332.	411.	491.
548.	570.	572.	558.	532.	495.	451.
407.	363.	326.	300.	282.	264.	244.
223.	204.	193.	193.	211.	219.	219.
212.	201.	188.	174.	160.	147.	135.
125.	115.	109.	117.	124.	127.	128.
125.	120.	113.	106.	99.	92.	86.
81.	75.	70.	65.	61.	57.	53.
49.	46.	43.	40.	37.	35.	33.
32.	30.	29.	27.	26.	25.	24.
23.	22.	21.	20.	19.	19.	18.
17.	16.	16.	15.	14.	14.	13.
13.	12.	12.	11.	11.	10.	10.
9.	9.	9.	8.	8.	8.	7.
7.	6.	6.	5.	5.	4.	4.
3.	3.	3.	2.	2.	2.	2.
2.	2.	2.	2.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.
0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.

```
ADD HYD          ID=3    HYD NO=  2    ID I=1        ID II=2          *
PRINT HYD        ID=3    CODE=0
```

OUTFLOW HYDROGRAPH REACH 2

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
12.500	0.	18.833	192.	25.166	44.	31.499	23.	37.832	17.
12.667	0.	19.000	178.	25.333	43.	31.666	22.	37.999	16.
12.833	0.	19.166	166.	25.499	42.	31.832	22.	38.165	15.
13.000	0.	19.333	154.	25.666	41.	31.999	22.	38.332	14.
13.167	1.	19.500	144.	25.833	40.	32.166	22.	38.499	13.
13.333	2.	19.666	134.	25.999	39.	32.332	22.	38.665	12.
13.500	9.	19.833	128.	26.166	39.	32.499	22.	38.832	11.
13.667	36.	20.000	136.	26.333	38.	32.666	22.	38.999	10.
13.833	89.	20.166	143.	26.499	37.	32.832	22.	39.165	9.
14.000	169.	20.333	146.	26.666	36.	32.999	21.	39.332	9.
14.167	254.	20.500	147.	26.833	36.	33.166	21.	39.499	8.
14.333	333.	20.666	144.	26.999	35.	33.332	21.	39.665	7.
14.500	412.	20.833	139.	27.166	34.	33.499	20.	39.832	7.
14.667	493.	21.000	133.	27.333	34.	33.666	20.	39.999	6.
14.833	550.	21.166	126.	27.499	33.	33.832	20.	40.165	6.
15.000	574.	21.333	119.	27.666	33.	33.999	20.	40.332	5.
15.167	577.	21.500	112.	27.833	32.	34.166	20.	40.499	5.
15.333	564.	21.666	106.	27.999	32.	34.332	20.	40.665	4.
15.500	540.	21.833	101.	28.166	31.	34.499	20.	40.832	4.
15.667	504.	22.000	95.	28.333	31.	34.666	19.	40.998	4.
15.833	461.	22.166	90.	28.499	30.	34.832	19.	41.165	3.
16.000	418.	22.333	85.	28.666	30.	34.999	19.	41.332	3.
16.167	375.	22.500	81.	28.833	29.	35.165	19.	41.498	3.
16.333	339.	22.666	77.	28.999	29.	35.332	19.	41.665	3.
16.500	314.	22.833	73.	29.166	29.	35.499	19.	41.832	3.
16.667	296.	23.000	69.	29.333	28.	35.665	19.	41.998	2.
16.833	279.	23.166	66.	29.499	28.	35.832	19.	42.165	2.
17.000	259.	23.333	63.	29.666	28.	35.999	19.	42.332	2.
17.167	239.	23.500	60.	29.832	27.	36.165	19.	42.498	2.
17.333	220.	23.666	57.	29.999	27.	36.332	19.	42.665	2.
17.500	209.	23.833	55.	30.166	26.	36.499	19.	42.832	2.
17.667	210.	24.000	53.	30.332	26.	36.665	19.	42.998	2.
17.833	228.	24.166	52.	30.499	25.	36.832	19.	43.165	1.
18.000	236.	24.333	50.	30.666	25.	36.999	19.	43.332	1.
18.167	236.	24.499	49.	30.832	24.	37.165	19.	43.498	1.
18.333	230.	24.666	47.	30.999	24.	37.332	19.	43.665	1.
18.500	219.	24.833	46.	31.166	23.	37.499	19.	43.832	1.
18.667	206.	24.999	45.	31.332	23.	37.665	18.		

RUNOFF VOLUME = 1.619 INCHES
PEAK DISCHARGE RATE = 576.8 CFS

```
* ROUTE THROUGH REACH 3.
*
STORE TRAVEL TIME   ID=1    REACH NO=  3.0 LENGTH=    3330. FT
                    SLOPE=0.002450FT/FT
                    DEPTH(FT)      FLOW(CFS)      TIME(HRS)
                       0.45              2.          0.862
                       0.96             10.          0.548
                       1.45             23.          0.414
                       1.92             41.          0.343
                       2.37             63.          0.299
                       2.80             90.          0.267
                       3.22            122.          0.245
                       3.58            160.          0.253
                       3.99            215.          0.270
                       4.32            287.          0.291
                       4.69            403.          0.316
                       5.10            592.          0.324
                       5.57            887.          0.327
                       6.03           1273.          0.321
                       6.45           1724.          0.337
                       6.91           2527.          0.335
                       7.40           3561.          0.333
                       7.86           4956.          0.329
                       8.31           6826.          0.304
ROUTE               ID=1    HYD NO=102      INFLOW ID=3          DT=0.200000HRS
PRINT HYD           ID=1    CODE=1

                                  PARTIAL HYDROGRAPH  102

     RUNOFF VOLUME =      1.619 INCHES
     PEAK DISCHARGE RATE =      536.6 CFS
```

```
* COMPUTE THE HYD FROM AREA 303.                                          *
*
RECALL HYD          ID=2    HYD NO=303   DT= 0.166667 HRS   DA=   1.108 SQ MI
                    PEAK=   674.CFS    RO= 4.131 INCHES   NO PTS=175
                    FLOW RATES
                          0.      0.      0.      0.      1.      2.      8.
                         33.     84.    164.    253.    341.    433.    528.
                        604.    648.    671.    674.    660.    632.    594.
                        550.    504.    462.    428.    404.    379.    354.
                        328.    304.    287.    281.    292.    297.    295.
                        285.    273.    257.    240.    223.    206.    191.
                        177.    164.    155.    160.    165.    168.    169.
                        166.    162.    155.    148.    140.    132.    125.
                        118.    110.    103.     97.     90.     85.     80.
                         75.     71.     67.     63.     60.     56.     53.
                         51.     48.     46.     43.     42.     40.     38.
                         37.     35.     34.     33.     32.     31.     29.
                         28.     27.     26.     26.     25.     24.     23.
                         22.     21.     21.     20.     19.     19.     18.
                         17.     17.     16.     16.     15.     14.     14.
                         13.     13.     13.     12.     12.     11.     11.
                         11.     10.     10.      9.      9.      9.      8.
                          8.      8.      8.      7.      7.      7.      7.
                          6.      6.      5.      5.      4.      4.      3.
                          3.      2.      2.      2.      2.      2.      2.
                          2.      2.      2.      1.      1.      1.      1.
                          1.      1.      1.      1.      1.      0.      0.
                          0.      0.      0.      0.      0.      0.      0.
                          0.      0.      0.      0.      0.      0.      0.
                          0.      0.      0.      0.      0.      0.      0.
```

```
* TO OBTAIN THE OUTFLOW FROM REACH 3, ADD HYD  FROM AREA 303 TO ROUTED HYD 102.*
*
ADD HYD              ID=3     HYD NO=  3     ID I=1          ID II=2
PRINT HYD            ID=3     CODE=0
```

OUTFLOW HYDROGRAPH REACH 3

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
12.500	0.	19.000	424.	25.499	78.	31.999	31.	38.499	15.
12.667	0.	19.166	395.	25.666	76.	32.166	30.	38.665	14.
12.833	0.	19.333	368.	25.833	74.	32.332	30.	38.832	13.
13.000	0.	19.500	342.	25.999	72.	32.499	30.	38.999	12.
13.167	1.	19.666	318.	26.166	71.	32.666	30.	39.165	11.
13.333	3.	19.833	300.	26.333	68.	32.832	28.	39.332	10.
13.500	9.	20.000	300.	26.499	66.	32.999	28.	39.499	9.
13.667	42.	20.166	305.	26.666	64.	33.166	28.	39.665	9.
13.833	120.	20.333	310.	26.833	62.	33.332	28.	39.832	8.
14.000	252.	20.500	313.	26.999	62.	33.499	27.	39.999	7.
14.167	406.	20.666	311.	27.166	60.	33.666	27.	40.165	7.
14.333	558.	20.833	305.	27.333	58.	33.832	26.	40.332	6.
14.500	709.	21.000	294.	27.499	57.	33.999	25.	40.499	6.
14.667	870.	21.166	283.	27.666	55.	34.166	24.	40.665	5.
14.833	1011.	21.333	268.	27.833	54.	34.332	24.	40.832	5.
15.000	1110.	21.500	253.	27.999	53.	34.499	23.	40.998	5.
15.167	1174.	21.666	239.	28.166	52.	34.666	23.	41.165	4.
15.333	1202.	21.833	225.	28.333	50.	34.832	22.	41.332	4.
15.500	1197.	22.000	212.	28.499	50.	34.999	22.	41.498	4.
15.667	1160.	22.166	199.	28.666	48.	35.165	21.	41.665	4.
15.833	1103.	22.333	188.	28.833	47.	35.332	21.	41.832	3.
16.000	1031.	22.500	176.	28.999	46.	35.499	21.	41.998	3.
16.167	953.	22.666	167.	29.166	45.	35.665	21.	42.165	3.
16.333	877.	22.833	157.	29.333	45.	35.832	21.	42.332	3.
16.500	810.	23.000	149.	29.499	43.	35.999	21.	42.498	3.
16.667	759.	23.166	141.	29.666	42.	36.165	21.	42.665	3.
16.833	710.	23.333	134.	29.832	42.	36.332	20.	42.832	2.
17.000	662.	23.500	127.	29.999	40.	36.499	20.	42.998	2.
17.167	614.	23.666	121.	30.166	40.	36.665	20.	43.165	2.
17.333	569.	23.833	114.	30.332	39.	36.832	20.	43.332	2.
17.500	533.	24.000	109.	30.499	38.	36.999	20.	43.498	2.
17.667	514.	24.166	105.	30.666	37.	37.165	20.	43.665	2.
17.833	520.	24.333	100.	30.832	36.	37.332	20.	43.832	2.
18.000	526.	24.499	97.	30.999	35.	37.499	20.	43.998	1.
18.167	526.	24.666	92.	31.166	35.	37.665	20.	44.165	1.
18.333	516.	24.833	90.	31.332	33.	37.832	18.	44.332	1.
18.500	502.	24.999	87.	31.499	33.	37.999	17.	44.498	1.
18.667	479.	25.166	84.	31.666	32.	38.165	16.	44.665	1.
18.833	452.	25.333	81.	31.832	31.	38.332	16.	44.832	1.

RUNOFF VOLUME = 2.375 INCHES
PEAK DISCHARGE RATE = 1201.8 CFS

```
* ROUTE THROUGH REACH 4.
*
STORE TRAVEL TIME   ID=1    REACH NO=  4.0 LENGTH=    3415. FT
                    SLOPE=0.003000FT/FT
                    DEPTH(FT)      FLOW(CFS)      TIME(HRS)
                       0.38              2.          0.878
                       0.84              7.          0.614
                       1.25             15.          0.472
                       1.69             28.          0.390
                       2.14             45.          0.339
                       2.54             62.          0.319
                       3.15            104.          0.268
                       3.75            155.          0.233
                       4.32            223.          0.208
                       4.87            305.          0.200
                       5.36            403.          0.202
                       5.82            554.          0.231
                       6.32            814.          0.251
                       6.83           1196.          0.249
                       7.28           1598.          0.253
                       7.69           2078.          0.262
                       8.27           3122.          0.257
                       8.86           4498.          0.246
                       9.47           6405.          0.230
ROUTE               ID=1    HYD NO=103      INFLOW ID=3          DT=0.200000HRS
PRINT HYD           ID=1    CODE=1

                                  PARTIAL HYDROGRAPH  103

     RUNOFF VOLUME =      2.375 INCHES
     PEAK DISCHARGE RATE =     1159.1 CFS


* COMPUTE THE HYD FROM AREA 304.
*
RECALL HYD          ID=2    HYD NO=304   DT= 0.250000 HRS   DA=   0.807 SQ MI
                    PEAK=   504.CFS    RO= 4.111 INCHES   NO PTS=119
                    FLOW RATES
                        0.      0.      0.      1.      8.     53.    153.
                      258.    359.    457.    499.    504.    482.    438.
                      385.    336.    299.    275.    248.    220.    201.
                      211.    218.    217.    215.    207.    192.    173.
                      154.    137.    122.    108.     97.     88.     79.
                       72.     66.     60.     54.     51.     51.     49.
                       47.     45.     43.     41.     39.     37.     35.
                       33.     30.     28.     26.     24.     23.     21.
                       20.     19.     18.     17.     16.     15.     14.
                       13.     12.     12.     11.     11.     10.      9.
                        9.      8.      8.      8.      7.      7.      6.
                        6.      5.      4.      4.      3.      2.      2.
                        2.      2.      2.      2.      1.      1.      1.
                        1.      1.      1.      1.      0.      0.      0.
                        0.      0.      0.      0.      0.      0.      0.
                        0.      0.      0.      0.      0.      0.      0.
                        0.      0.      0.      0.      0.      0.      0.
```

```
* ADD THE HYD FROM AREA 304 TO THE PARTIAL HYD 103 TO OBTAIN THE OUTFLOW FROM  *
* REACH 4.
*
ADD HYD            ID=3     HYD NO=  4     ID I=1         ID II=2
PRINT HYD          ID=3    CODE=0
```

OUTFLOW HYDROGRAPH REACH 4

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
12.500	0.	19.300	588.	26.100	96.	32.900	32.	39.700	10.
12.700	0.	19.500	537.	26.300	92.	33.100	31.	39.900	9.
12.900	0.	19.700	489.	26.500	89.	33.300	30.	40.100	9.
13.100	0.	19.900	450.	26.700	86.	33.500	30.	40.300	8.
13.300	3.	20.100	426.	26.900	83.	33.700	29.	40.500	7.
13.500	10.	20.300	414.	27.100	80.	33.900	28.	40.700	6.
13.700	56.	20.500	407.	27.300	78.	34.100	28.	40.900	6.
13.900	179.	20.700	401.	27.500	75.	34.300	27.	41.100	5.
14.100	399.	20.900	389.	27.700	73.	34.500	25.	41.300	5.
14.300	651.	21.100	374.	27.900	70.	34.700	25.	41.500	5.
14.500	869.	21.300	355.	28.100	68.	34.900	24.	41.700	4.
14.700	1099.	21.500	334.	28.300	66.	35.100	23.	41.900	4.
14.900	1308.	21.700	313.	28.500	63.	35.300	23.	42.100	4.
15.100	1477.	21.900	291.	28.700	62.	35.500	23.	42.300	4.
15.300	1587.	22.100	270.	28.900	60.	35.700	23.	42.500	3.
15.500	1630.	22.300	252.	29.100	58.	35.900	22.	42.700	3.
15.700	1606.	22.500	237.	29.300	57.	36.100	22.	42.900	3.
15.900	1535.	22.700	223.	29.500	55.	36.300	21.	43.100	3.
16.100	1434.	22.900	211.	29.700	53.	36.500	21.	43.300	3.
16.300	1321.	23.100	198.	29.900	51.	36.700	21.	43.500	2.
16.500	1210.	23.300	187.	30.100	50.	36.900	20.	43.700	2.
16.700	1118.	23.500	176.	30.300	48.	37.100	20.	43.900	2.
16.900	1036.	23.700	167.	30.500	47.	37.300	20.	44.100	2.
17.100	956.	23.900	158.	30.700	46.	37.500	20.	44.300	2.
17.300	878.	24.100	150.	30.900	45.	37.700	20.	44.500	2.
17.500	809.	24.300	143.	31.100	43.	37.900	19.	44.700	2.
17.700	774.	24.500	136.	31.300	42.	38.100	18.	44.900	2.
17.900	757.	24.700	129.	31.500	40.	38.300	17.	45.100	1.
18.100	751.	24.900	123.	31.700	39.	38.500	16.	45.300	1.
18.300	744.	25.100	117.	31.900	38.	38.700	15.	45.500	1.
18.500	734.	25.300	112.	32.100	36.	38.900	14.	45.700	1.
18.700	713.	25.500	108.	32.300	35.	39.100	13.		
18.900	680.	25.700	103.	32.500	34.	39.300	12.		
19.100	637.	25.900	100.	32.700	33.	39.500	11.		

RUNOFF VOLUME = 2.686 INCHES
PEAK DISCHARGE RATE = 1630.0 CFS

```
* ROUTE THROUGH REACH 5.
*
STORE TRAVEL TIME   ID=1    REACH NO=  5.0 LENGTH=    3310. FT
                    SLOPE=0.003000FT/FT
                    DEPTH(FT)      FLOW(CFS)      TIME(HRS)
                       0.35              2.          0.749
                       0.96              9.          0.542
                       1.57             26.          0.400
                       2.19             52.          0.317
                       2.82             90.          0.267
                       3.45            141.          0.231
                       4.28            237.          0.220
                       5.30            461.          0.210
                       6.13            818.          0.208
                       6.83           1317.          0.195
                       7.47           1958.          0.177
                       8.09           2750.          0.161
                       8.71           3713.          0.148
                       9.31           4861.          0.137
                       9.78           5880.          0.132
                      10.18           6694.          0.132
                      10.77           8589.          0.127
                      11.33          11067.          0.120
                      11.89          14199.          0.113
ROUTE               ID=1    HYD NO=104      INFLOW ID=3          DT=0.200000HRS
PRINT HYD           ID=1    CODE=1

                                PARTIAL HYDROGRAPH  104

     RUNOFF VOLUME =      2.686 INCHES
     PEAK DISCHARGE RATE =     1610.2 CFS


RECALL HYD          ID=2    HYD NO=305   DT= 0.333333 HRS   DA=   1.875 SQ MI
                    PEAK=   937.CFS    RO= 3.837 INCHES   NO PTS=117
                    FLOW RATES
                         0.      0.      0.      2.     28.    157.    363.
                       614.    821.    924.    937.    880.    793.    729.
                       674.    610.    550.    517.    474.    425.    373.
                       324.    278.    240.    216.    197.    182.    167.
                       155.    145.    136.    128.    119.    111.    104.
                        98.     93.     87.     81.     75.     70.     65.
                        60.     56.     52.     49.     46.     43.     41.
                        38.     36.     34.     32.     30.     29.     27.
                        26.     24.     23.     22.     21.     20.     18.
                        17.     17.     16.     15.     14.     13.     13.
                        12.     11.     11.     10.      9.      9.      8.
                         8.      8.      7.      7.      6.      6.      6.
                         5.      5.      5.      4.      3.      2.      1.
                         1.      1.      1.      1.      1.      1.      1.
                         0.      0.      0.      0.      0.      0.      0.
                         0.      0.      0.      0.      0.      0.      0.
                         0.      0.      0.      0.      0.
```

```
  ADD THE HYD FROM AREA 305 TO THE PARTIAL HYD 104.

ADD HYD              ID=3     HYD NO=105      ID I=1          ID II=2
PRINT HYD            ID=3    CODE=1

                                    PARTIAL HYDROGRAPH  105

     RUNOFF VOLUME =       3.025 INCHES
     PEAK DISCHARGE RATE =      2542.0 CFS


* THE HYD FROM AREA 306 IS RECALLED AND USED AS THE INFLOW HYD TO RESERVOIR 502
*
RECALL HYD           ID=5    HYD NO=306   DT= 0.250000 HRS   DA=   0.483 SQ MI
                     PEAK=   638.CFS    RO= 3.369 INCHES   NO PTS= 61  FLOW RATE
                           0.      0.      0.      0.     45.    280.    560.
                         638.    570.    370.    258.    170.     97.     72.
                          64.     61.     80.     70.     59.     54.     52.
                          51.     50.     46.     44.     40.     38.     33.
                          30.     27.     25.     24.     23.     22.     21.
                          20.     20.     19.     18.     16.     16.     15.
                          13.     11.     10.      9.      8.      7.      6.
                           5.      5.      5.      4.      4.      3.      3.
                           3.      2.      2.      2.      1.
* ROUTE THE HYD FROM AREA 306 THROUGH RESERVOIR 502.
*
ROUTE RESERVOIR      ID=1   HYD NO=502   INFLOW ID=5
                     OUTFLOW(CFS)   STORAGE(AC FT)
                              0              1
                             .1            2.5
                             .2              5
                             .4              8
                             .6             15
                             6.            148
                             50            155
                            200            167
                            500            180
PRINT HYD            ID=1   CODE=1

                                    OUTFLOW HYDROGRAPH RESERVOIR  502

     RUNOFF VOLUME =       0.369 INCHES
     PEAK DISCHARGE RATE =        3.4 CFS
```

```
* ROUTE OUTFLOW FROM RESERVOIR 502 THROUGH REACH 6.
*
STORE TRAVEL TIME   ID=2    REACH NO=  6.0 LENGTH=    4080. FT
                    SLOPE=0.007500FT/FT
                    DEPTH(FT)      FLOW(CFS)      TIME(HRS)
                       0.44              5.          0.589
                       0.80             16.          0.406
                       1.18             33.          0.335
                       1.52             56.          0.285
                       1.88             88.          0.252
                       2.26            146.          0.249
                       2.66            251.          0.248
                       3.10            421.          0.240
                       3.55            675.          0.228
                       4.00           1019.          0.216
                       4.46           1482.          0.205
                       4.93           2102.          0.192
                       5.40           2902.          0.179
                       5.88           3908.          0.167
                       6.37           5214.          0.154
                       6.85           6796.          0.142
                       7.33           8649.          0.132
                       7.80          10796.          0.123
                       8.28          13261.          0.116
ROUTE               ID=2    HYD NO=106      INFLOW ID=1          DT=0.200000HRS
PRINT HYD           ID=2    CODE=1

                                  PARTIAL HYDROGRAPH  106

     RUNOFF VOLUME =      0.381 INCHES
     PEAK DISCHARGE RATE =       3.4 CFS
```

```
* TO OBTAIN THE OUTFLOW HYD FROM REACH 5, ADD PARTIAL HYDS 106 AND 105.        *
*
ADD HYD              ID=6     HYD NO=  5     ID I=3         ID II=2
PRINT HYD            ID=6    CODE=0
```

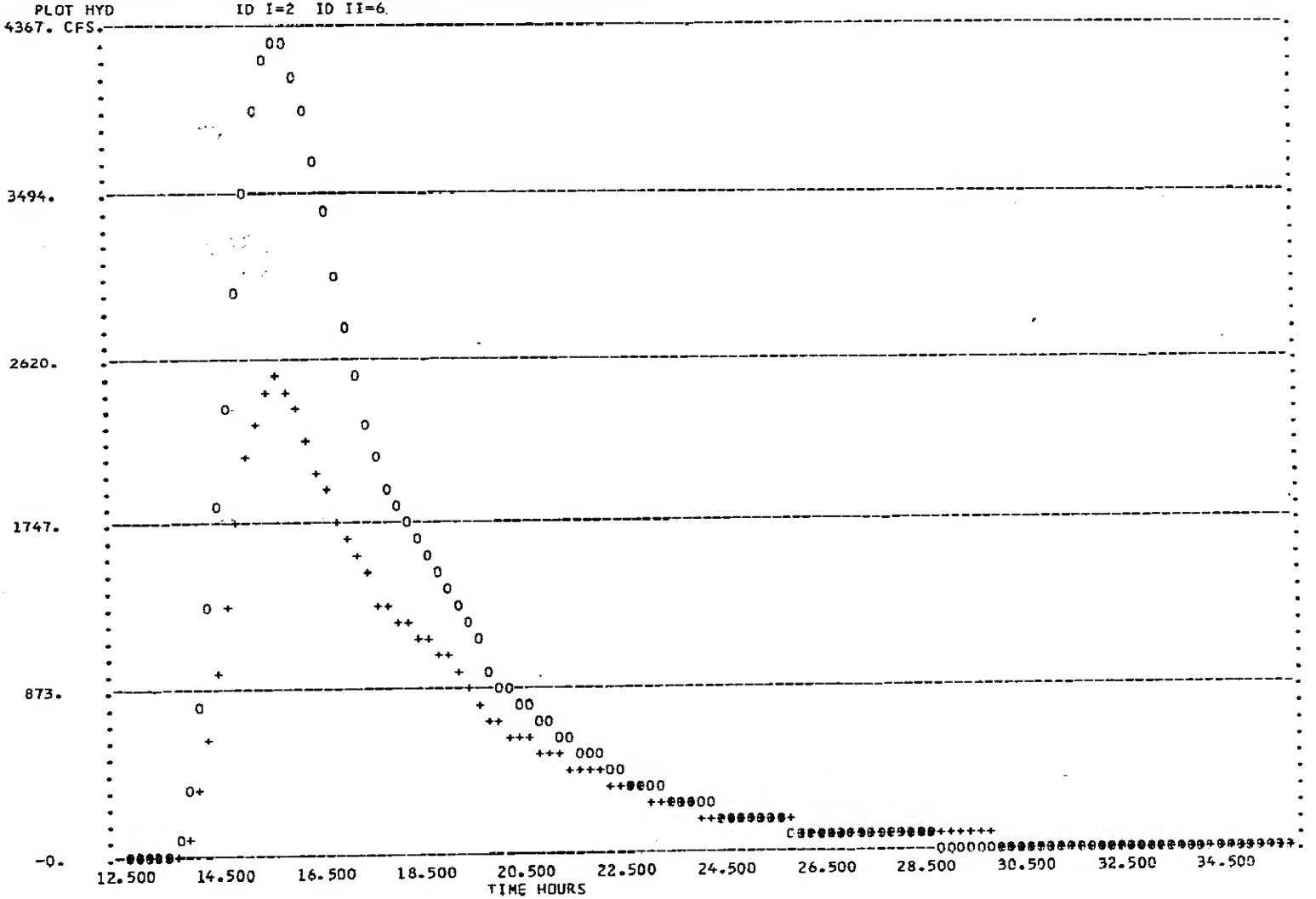
OUTFLOW HYDROGRAPH REACH 5

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
12.500	0.	20.700	617.	28.900	103.	37.100	33.	45.300	5.
12.700	0.	20.900	597.	29.100	100.	37.300	33.	45.500	5.
12.900	0.	21.100	575.	29.300	97.	37.500	33.	45.700	5.
13.100	0.	21.300	551.	29.500	94.	37.700	32.	45.900	5.
13.300	1.	21.500	524.	29.700	91.	37.900	31.	46.100	4.
13.500	4.	21.700	496.	29.900	88.	38.100	31.	46.300	4.
13.700	30.	21.900	469.	30.100	85.	38.300	30.	46.500	4.
13.900	123.	22.100	442.	30.300	83.	38.500	29.	46.700	3.
14.100	354.	22.300	417.	30.500	81.	38.700	28.	46.900	3.
14.300	675.	22.500	394.	30.700	78.	38.900	26.	47.100	3.
14.500	1016.	22.700	373.	30.900	76.	39.100	25.	47.300	3.
14.700	1391.	22.900	354.	31.100	74.	39.300	24.	47.500	3.
14.900	1765.	23.100	335.	31.300	72.	39.500	22.	47.700	3.
15.100	2100.	23.300	318.	31.500	69.	39.700	21.	47.900	3.
15.300	2347.	23.500	302.	31.700	67.	39.900	20.	48.100	3.
15.500	2509.	23.700	287.	31.900	65.	40.100	20.	48.299	3.
15.700	2544.	23.900	274.	32.100	63.	40.300	18.	48.499	3.
15.900	2504.	24.100	261.	32.300	61.	40.500	17.	48.699	3.
16.100	2394.	24.300	250.	32.500	60.	40.700	16.	48.899	3.
16.300	2249.	24.500	240.	32.700	58.	40.900	15.	49.099	3.
16.500	2090.	24.700	228.	32.900	56.	41.100	15.	49.299	3.
16.700	1952.	24.900	217.	33.100	54.	41.300	14.	49.499	3.
16.900	1828.	25.100	207.	33.300	52.	41.500	13.	49.699	3.
17.100	1714.	25.300	198.	33.500	51.	41.700	12.	49.899	3.
17.300	1599.	25.500	190.	33.700	50.	41.900	11.	50.099	3.
17.500	1487.	25.700	182.	33.900	49.	42.100	10.	50.299	3.
17.700	1394.	25.900	175.	34.100	48.	42.300	9.	50.499	3.
17.900	1329.	26.100	169.	34.300	47.	42.500	8.	50.699	2.
18.100	1291.	26.300	162.	34.500	45.	42.700	8.	50.899	2.
18.300	1257.	26.500	156.	34.700	44.	42.900	8.	51.099	2.
18.500	1222.	26.700	150.	34.900	42.	43.100	8.	51.299	2.
18.700	1178.	26.900	144.	35.100	41.	43.300	7.	51.499	2.
18.900	1125.	27.100	139.	35.300	40.	43.500	7.	51.699	2.
19.100	1061.	27.300	134.	35.500	39.	43.700	7.	51.899	1.
19.300	990.	27.500	130.	35.700	39.	43.900	7.	52.099	1.
19.500	914.	27.700	126.	35.900	38.	44.100	7.	52.299	1.
19.700	838.	27.900	121.	36.100	37.	44.300	7.	52.499	1.
19.900	767.	28.100	117.	36.300	36.	44.500	6.	52.699	1.
20.100	707.	28.300	113.	36.500	36.	44.700	6.		
20.300	666.	28.500	110.	36.700	35.	44.900	6.		
20.500	637.	28.700	106.	36.900	34.	45.100	5.		

```
RUNOFF VOLUME =      2.838 INCHES
PEAK DISCHARGE RATE =     2544.1 CFS
```

```
* THE SEDIMENT YIELD COMMAND IS USED TO COMPUTE THE SEDIMENT YIELD PRODUCED BY *
* THE ROUTED FLOOD.
*
SEDIMENT YIELD      ID=6   SCIL=.34   CROP=.16   CP=.4   LS=.3
     SEDIMENT YIELD =      2444.6 TONS
* RECALL THE REACH 5 OUTFLOW HYD ROUTED WITH PRESENT CONDITIONS.
*
RECALL HYD          ID=2    HYD NO=  5   DT= 0.200000 HRS   DA=   6.844 SQ MI
                    PEAK=  4367.CFS    RO= 4.196 INCHES   NO PTS=194
                    FLOW RATES
                          0.      0.      0.      0.      3.     15.    106.
                        378.    829.   1349.   1855.   2403.   2983.   3537.
                       3968.   4260.   4367.   4337.   4181.   3950.   3684.
                       3415.   3143.   2880.   2611.   2353.   2137.   1978.
                       1869.   1783.   1707.   1628.   1541.   1446.   1347.
                       1244.   1141.   1044.    959.    889.    833.    788.
                        749.    714.    678.    641.    604.    568.    532.
                        497.    466.    436.    407.    379.    354.    331.
                        312.    294.    279.    265.    251.    237.    223.
                        211.    200.    190.    181.    172.    164.    156.
                        148.    141.    135.    129.    123.    118.    112.
                        107.    103.     98.     94.     89.     85.     81.
                         78.     75.     72.     69.     67.     64.     61.
                         59.     56.     54.     52.     49.     47.     45.
                         42.     40.     38.     36.     35.     33.     31.
                         30.     29.     28.     26.     25.     24.     22.
                         21.     20.     19.     18.     17.     16.     15.
                         15.     14.     13.     13.     12.     12.     11.
                         11.     10.     10.      9.      9.      7.      7.
                          7.      7.      6.      6.      6.      6.      6.
                          5.      5.      5.      5.      4.      4.      3.
                          3.      2.      2.      1.      1.      1.      1.
                          1.      1.      1.      1.      1.      1.      1.
                          1.      1.      0.      0.      0.      0.      0.
                          0.      0.      0.      0.      0.      0.      0.
                          0.      0.      0.      0.      0.      0.      0.
                          0.      0.      0.      0.      0.      0.      0.
                          0.      0.      0.      0.      0.
```

```
* PLOT THE REACH 5 OUTFLOW HYDS ROUTED WITH PRESENT CONDITIONS AND WITH        *
* RESERVOIRS.
* PLOT SYMBOLS   PRESENT CONDITIONS—0—   WITH RESERVOIRS—+—
PLOT HYD            ID I=2  ID II=6.
```




```
FINISH
```

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APPENDIX
HYMO MAIN PROGRAM AND SUBROUTINES

```
      //$OPTIONS
      C                                   HYMO                                                A    1
      C                                                                                       A    2
      C                                                                                       A    3
      C     THIS PROGRAM IS A PROBLEM ORIENTED COMPUTER LANGUAGE FOR                          A    4
      C     DEVELOPING WATERSHED MODELS.                                                      A    5
      C                                                                                       A    6
      C                                                                                       A    7
      C     DEFINITION OF VARIABLES                                                           A    8
      C     ID = STORAGE LOCATION NUMBER                                                      A    9
      C     NHD = HYDROGRAPH IDENTIFICATION NUMBER                                            A   10
      C     DT = TIME INCREMENT IN HOURS                                                      A   11
      C     DA = DRAINAGE AREA IN SQ MI                                                       A   12
      C     QCFS = FLOW RATE ARRAY                                                            A   13
      C     QCFSF = CUTOFF FLOW RATE IN CFS                                                   A   14
      C     IEND = NUMBER OF POINTS IN A HYDROGRAPH                                           A   15
      C     SCFS = FLOW RATE ARRAY FOR TRAVEL TIME TABLE                                      A   16
      C     A = END AREA IN SQ FT                                                             A   17
      C     Q = FLOW RATE ARRAY FOR RATING CURVES                                             A   18
      C     RAIN = MASS RAINFALL ARRAY                                                        A   19
     1      COMMON CFS(300),QCFS(300,6),IEND(6),DATA(310),DA(6),DP(20),NPU,NHD                A   20
           1,SCFS(20),C(20),A(20,6),Q(20,6),RAIN(200),DEEP(20,6),NER,MAXNO,NCO               A   21
           2MM,ICC,NCODE,DIST(6),SEGN(6),CTBLE(50,11),ITBLE(50,2),ZALFA(20),DT               A   22
           3(6),TIME,PEAK(6),ROIN,ISG(6)                                                     A   23
     2     NCODE=0                                                                           A   24
      C     READ ZALFA ARRAY                                                                 A   25
     3     READ (5,20) (ZALFA(I),I=1,15)                                                     A   26
      C     READ NUMBER OF COMMANDS                                                          A   27
     4     READ (5,21) NCOMM                                                                 A   28
      C     READ COMMAND TABLE                                                               A   29
     5     READ (5,22) ((CTBLE(I,J),J=1,11),(ITBLE(I,J),J=1,2),I=1,NCOMM)                    A   30
     6     WRITE (6,23) (ZALFA(I),I=1,15)                                                    A   31
     7     WRITE (6,24)                                                                      A   32
     8     WRITE (6,25) ((CTBLE(I,J),J=1,11),(ITBLE(I,J),J=1,2),I=1,NCOMM)                   A   33
      C     ZERO CODES -- NPU = PUNCH, ICC = CONTINUATION CARD, NER = ERROR                  A   34
     9     NPU=0                                                                             A   35
    10     ICC=0                                                                             A   36
    11   1 NER=0                                                                             A   37
    12     CALL HONDO                                                                        A   38
    13     IF (NER) 2,2,19                                                                   A   39
    14   2 GO TO (3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19), NCODE                        A   40
    15   3 TIME=DATA(1)                                                                      A   41
    16     NPU=DATA(2)                                                                       A   42
    17     GO TO 1                                                                           A   43
    18   4 CALL STHYD                                                                        A   44
    19     GO TO 1                                                                           A   45
    20   5 CALL RECHD                                                                        A   46
    21     GO TO 1                                                                           A   47
    22   6 CALL CMPHYD                                                                       A   48
    23     GO TO 1                                                                           A   49
    24   7 CALL PRTHYD                                                                       A   50
    25     GO TO 1                                                                           A   51
    26   8 CALL PUHYD                                                                        A   52
    27     GO TO 1                                                                           A   53
    28   9 CALL HPLOT                                                                        A   54
    29     GO TO 1                                                                           A   55
    30  10 CALL ADHYD                                                                        A   56
    31     GO TO 1                                                                           A   57
    32  11 CALL SRC                                                                         A   58
    33     GO TO 1                                                                           A   59
    34  12 CALL CMPRC
```

```
35          GO TO 1                                                          A  60
36    13    CALL STT                                                         A  61
37          GO TO 1                                                          A  62
38    14    CALL CMPTT                                                       A  63
39          GO TO 1                                                          A  64
40    15    CALL ROUTE                                                       A  65
41          GO TO 1                                                          A  66
42    16    CALL RESVO                                                       A  67
43          GO TO 1                                                          A  68
44    17    CALL ERROR                                                       A  69
45          GO TO 1                                                          A  70
46    18    CALL SEDT                                                        A  71
47          GO TO 1                                                          A  72
48    19    STOP                                                             A  73
      C                                                                      A  74
49    20    FORMAT (15A1)                                                    A  75
50    21    FORMAT (I2)                                                      A  76
51    22    FORMAT (2A1,9A2,2I3)                                             A  77
52    23    FORMAT (1H1,9X,8HZALFA = ,15A1///)                               A  78
53    24    FORMAT (16X,13HCOMMAND TABLE//)                                  A  79
54    25    FORMAT (10X,2A1,9A2,2I3)                                         A  80
55          END                                                              A  81-

56          SUBROUTINE HONDO                                                 B   1
      C     THIS SUBROUTINE READS IN A DATA CARD , SEARCHES AN ALPHAMERIC    B   2
      C     CODE TABLE TO DETERMINE THE NCODE OF THE OPERATION AND           B   3
      C     COLLECTS VARIABLES FROM THE FREEFLOATING DATA FIELD              B   4
57          COMMON CFS(300),OCFS(300,6),IEND(6),DATA(310),DA(6),DP(20),NPU,NHD B   5
           1,SCFS(20),C(20),A(20,6),Q(20,6),RAIN(200),DEEP(20,6),NER,MAXNO,NCO B   6
           2MM,ICC,NCODE,DIST(6),SEGN(6),CTBLE(50,11),ITBLE(50,2),ZALFA(20),DT B   7
           3(6),TIME,PEAK(6),ROIN,ISG(6)                                    B   8
58          DIMENSION CHAR(60), ALPHA(11)                                    B   9
59          DIMENSION AUXA(10), AUXB(10)                                     B  10
60          IF (ICC) 1,1,3                                                   B  11
      C     READ IN DATA CARD                                                B  12
61    1     READ (5,42) (ALPHA(I),I=1,11),(CHAR(I),I=1,60)                   B  13
      C     IF FIRST CHARACTER IS BLANK THE CARD IS A CONTINUATION OF        B  14
      C     PREVIOUS CARD.                                                   B  15
62          IF (ALPHA(1)-ZALFA(11)) 2,9,2                                    B  16
63    2     IF (ICC) 3,3,40                                                  B  17
      C     ASTERISK IN COL. 80 MEANS SKIP TO NEW PAGE BEFORE PRINTING CARD  B  18
64    3     IF (CHAR(60)-ZALFA(11)) 4,5,4                                    B  19
65    4     WRITE (6,43)                                                     B  20
66    5     WRITE (6,44) (ALPHA(I),I=1,11),(CHAR(I),I=1,60)                  B  21
      C     IF FIRST CHARACTER IS A *  THE PREVIOUS CARD WAS A COMMENT CARD  B  22
67          IF (ALPHA(1)-ZALFA(12)) 10,6,10                                  B  23
      C     IF PUNCH CODE POSITIVE, COMMENT CARDS ARE PUNCHED.               B  24
68    6     IF (NPU) 8,8,7                                                   B  25
69    7     WRITE (7,45) (ALPHA(I),I=1,11),(CHAR(I),I=1,60)                  B  26
70    8     ICC=0                                                            B  27
71          GO TO 1                                                          B  28
72    9     WRITE (6,44) (ALPHA(I),I=1,11),(CHAR(I),I=1,60)                  B  29
73          GO TO 24                                                         B  30
      C     SEARCH FIRST TWO ALPHAMERIC CHARACTERS TO SEE IF THEY ARE NUMBERS B  31
74    10    ICC=1                                                            B  32
75          DO 12 I=1,10                                                     B  33
76          IF (ALPHA(1)-ZALFA(I)) 11,15,11                                  B  34
77    11    IF (ALPHA(2)-ZALFA(I)) 12,15,12                                  B  35
78    12    CONTINUE                                                         B  36
      C     STATEMENT NUMBER 7 IS BRANCHED TO IF NUMBERS ARE PRESENT         B  37
```

```
      C     IF NOT NUMBER SEARCH COMMAND TABLE FOR MATCH                          B  38
      C     CALL FIRST 10 VALUES FROM PERMANENT DATA STORAGE                      B  39
                                                                                  B  40
   79         DO 14 I=1,50                                                       B  41
   80         DO 13 J=1,11                                                       B  42
   81         IF (CTBLE(I,J)-ALPHA(J)) 14,13,14                                  B  43
      C     SN 10=PART MATCH                                                      B  44
   82   13    CONTINUE                                                           B  45
      C     IF THIS LOOP IS COMPLETED WE HAVE COMPLETE MATCH- CALL NCODE          B  46
      C     AND MAX NUMBER AND EXIT LOOP                                          B  47
   83         NCODE=ITBLE(I,1)                                                   B  48
   84         MAXNO=ITBLE(I,2)                                                   B  49
   85         GO TO 21                                                           B  50
   86   14    CONTINUE                                                           B  51
      C     IF MAJOR LOOPS FINISHED WITHOUT A MATCH WRITE ERROR MESSAGE           B  52
      C     AND SET NER  = 1                                                      B  53
   87         NER=1                                                              B  54
   88         WRITE (6,46)                                                       B  55
   89         RETURN                                                             B  56
      C     CONVERT DIGIT INPUT CODE FROM ALPHAMERIC TO INTEGER FORM              B  57
   90   15    NCODE=GIT(ALPHA,1,2,1.)+0.5                                        B  58
      C     FIND MAX NUMBER OF DATA ITEMS FOR THIS NCODE                          B  59
   91         DO 17 I=1,50                                                       B  60
   92         IF (ITBLE(I,1)-NCODE) 17,16,17                                     B  61
   93   16    MAXNO=ITBLE(I,2)                                                   B  62
   94         GO TO 21                                                           B  63
   95   17    CONTINUE                                                           B  64
      C     SEARCH DATA ROUTINE                                                   B  65
      C     SEE IF ANY DATA FOR THIS CARD                                         B  66
   96         DO 19 I=1,50                                                       B  67
   97         IF (ITBLE(I,1)-NCODE) 19,18,19                                     B  68
   98   18    MAXNO=ITBLE(I,2)                                                   B  69
   99         GO TO 20                                                           B  70
  100   19    CONTINUE                                                           B  71
  101   20    CONTINUE                                                           B  72
  102   21    IF (MAXNO) 23,22,23                                                B  73
  103   22    RETURN                                                             B  74
      C      ZERO ARRAYS AND COUNTERS                                           B  75
  104   23    DO 47 I=1,310                                                      B  76
  105   47    DATA (I)=0.                                                        B  77
  106         NDATA=1                                                            B  78
  107   24    NCHAR=0                                                            B  79
  108   25    DO 26 I=1,10                                                       B  80
  109         AUXA(I)=0.                                                         B  81
  110   26    AUXB(I)=0.                                                         B  82
  111         IT1=1                                                              B  83
  112         IT2=1                                                              B  84
  113         SIGN=1.                                                            B  85
  114         LOGIT=0                                                            B  86
  115         KDGIT=0                                                            B  87
      C     CARRY OUT DIGIT BY DIGIT SEARCH AND ACCUMULATION                      B  88
  116   27    NCHAR=NCHAR+1                                                      B  89
      C     HAVE WE CONSIDERED ALL CHARACTERS - RETURN IF SO                      B  90
  117         IF (NCHAR-60) 28,32,1                                              B  91
  118   28    DO 29 I=1,15                                                       B  92
  119         IF (CHAR(NCHAR)-ZALFA(I)) 29,30,29                                 B  93
  120   29    CONTINUE                                                           B  94
  121         GO TO 32                                                           B  95
  122   30    GO TO (33,33,33,33,33,33,33,33,33,33,32,27,36,32,31,27), I         B  96
      C     SN 39  HANDLES SIGN CONTROL ON 1130 VERSION                           B  97
  123   31    SIGN=-1.0
```

```
124           GO TO 27                                                        B  98
      C       CHARACTER IS BLANK OR COMMA - DOES IT FOLLOW A DIGIT            B  99
125   32      GO TO (27,48), IT1                                              B 100
      C       CHARACTER IS A DIGIT - HAS A DECIMAL BEEN ENCOUNTERED           B 101
126   33      GO TO (34,35), IT2                                              B 102
127   34      LDGIT=LDGIT+1                                                   B 103
128           IT1=2                                                           B 104
129           AUXA(LDGIT)=CHAR(NCHAR)                                         B 105
130           GO TO 27                                                        B 106
131   35      KDGIT=KDGIT+1                                                   B 107
132           AUXB(KDGIT)=CHAR(NCHAR)                                         B 108
133           GO TO 27                                                        B 109
      C       CHARACTER IS A DECIMAL - DOES IT FOLLOW A DIGIT                 B 110
134   36      GO TO (37,38), IT1                                              B 111
135   37      IT1=2                                                           B 112
136           LDGIT=1                                                         B 113
137   38      IT2=2                                                           B 114
138           GO TO 27                                                        B 115
      C       ROUTINE TO CONVERT ALPHABETIC ARRAY TO FLOATING POINT NUMBER    B 116
139   48      DATA (NDATA)=GIT(AUXA,1,LDGIT,1.)+GIT(AUXB,1,10,0.)             B 117
140           DATA (NDATA)=DATA(NDATA)*SIGN                                   B 118
      C       IS ALL DATA FURNISHED  YES-RETURN  NO INCREASE N DATA KEEP ON   B 119
141           IF (NDATA-MAXNO) 41,39,39                                       B 120
142   39      ICC=0                                                           B 121
143   40      RETURN                                                          B 122
144   41      NDATA=NDATA+1                                                   B 123
145           GO TO 25                                                        B 124
      C                                                                       B 125
146   42      FORMAT (2A1,9A2,60A1)                                           B 126
147   43      FORMAT (1H1)                                                    B 127
148   44      FORMAT (5X,2A1,9A2,60A1)                                        B 128
149   45      FORMAT (2A1,9A2,60A1)                                           B 129
150   46      FORMAT (10X,20HCOMMAND NOT IN TABLE)                            B 130
151           END                                                             B 131-

152           FUNCTION GIT (TCARD,J,JLAST,SHIFT)                              C   1
153           DIMENSION TCARD(10), A(10)                                      C   2
154           DATA A(1)/1H1/,A(2)/1H2/,A(3)/1H3/,A(4)/1H4/,A(5)/1H5/,A(6)/1H6/ C   3
155           DATA A(7)/1H7/,A(8)/1H8/,A(9)/1H9/,A(10)/1H0/                   C   4
156           GIT=0.                                                          C   5
157           TEN=10.                                                         C   6
158           SUM=0.                                                          C   7
159           DO 3 JNOW=J,JLAST                                               C   8
160           TTEST=TCARD(JNOW)                                               C   9
      C       CHECK FOR LAST ENTRY                                            C  10
161           IF (TTEST.EQ.0.) GO TO 4                                        C  11
      C       FIND NUMBER AND COMPUTE VALUE                                   C  12
162           DO 2 NUMB=1,10                                                  C  13
163           IF (TTEST-A(NUMB)) 2,1,2                                        C  14
164   1       ZTEST=NUMB                                                      C  15
165           IF (ZTEST.EQ.10.) ZTEST=0.                                      C  16
166           SUM=SUM*TEN+ZTEST                                               C  17
167           GO TO 3                                                         C  18
168   2       CONTINUE                                                        C  19
169   3       CONTINUE                                                        C  20
170   4       IF (SHIFT) 6,5,6                                                C  21
171   5       FI=JNOW-1                                                       C  22
172           SUM=SUM*(0.1**FI)                                               C  23
173   6       GIT=SUM                                                         C  24
174           RETURN                                                          C  25
```

```
175           END                                                                C  26-

176           SUBROUTINE STHYD                                                   D   1
      C       THIS SUBROUTINE STORES THE COORDINATES OF HYDROGRAPHS.             D   2
177           COMMON CFS(300),OCFS(300,6),IEND(6),DATA(310),DA(6),DP(20),NPU,NHD  D   3
             1,SCFS(20),C(20),A(20,6),Q(20,6),RAIN(200),DEEP(20,6),NER,MAXNO,NCO  D   4
             2MM,ICC,NCODE,DIST(6),SEGN(6),CTBLE(50,11),ITBLE(50,2),ZALFA(20),DT  D   5
             3(6),TIME,PEAK(6),ROIN,ISG(6)                                       D   6
178           ID=DATA(1)                                                         D   7
179           NHD=DATA(2)                                                        D   8
180           DT(ID)=DATA(3)                                                     D   9
181           DA(ID)=DATA(4)                                                     D  10
182           J=5                                                                D  11
      C       REMAINING DATA ARE FLOW RATES                                      D  12
183           OCFS(1,ID)=DATA(J)                                                 D  13
184           PEAK(ID)=1.                                                        D  14
185           RO=DATA(J)                                                         D  15
186           DO 4 I=2,300                                                       D  16
187           J=J+1.                                                             D  17
188           OCFS(I,ID)=DATA(J)                                                 D  18
189           RO=RO+OCFS(I,ID)                                                   D  19
      C       IS FLOW RECEDING                                                   D  20
190           IF (OCFS(I,ID)-OCFS(I-1,ID)) 1,2,2                                 D  21
      C       HAS FLOW RECEDED TO CUTOFF RATE                                    D  22
191   1       IF (OCFS(I,ID)) 5,5,4                                              D  23
      C       DETERMINE PEAK FLOW                                                D  24
192   2       IF (OCFS(I,ID)-PEAK(ID)) 4,4,3                                     D  25
193   3       PEAK(ID)=OCFS(I,ID)                                                D  26
194   4       CONTINUE                                                           D  27
195   5       IEND(ID)=I-1                                                       D  28
196           M=IEND(ID)                                                         D  29
197           ROIN=(RO*DT(ID))/(DA(ID)*645.333)                                  D  30
      C       PUNCH CODE                                                         D  31
198           IF (NPU) 7,7,6                                                     D  32
199   6       WRITE (7,8) ID,NHD,DT(ID),DA(ID),PEAK(ID),ROIN,IEND(ID)            D  33
200           WRITE (7,9) (OCFS(J,ID),J=1,M)                                     D  34
201   7       RETURN                                                             D  35
      C                                                                          D  36
202   8       FORMAT(   'RECALL HYD',T21,'ID=',I1,T29,'HYD NO=',I3,T42,'DT=',F9. D  37
             16,' HRS',T61,'DA=',F8.3,' SQ MI'/T21,'PEAK=',F7.0,'CFS',T40,'RO=', D  38
             2F6.3,' INCHES',T59,'NO PTS=',I3/T21,'FLOW RATES')                  D  39
203   9       FORMAT (T21,7F8.0)                                                 D  40
204           END                                                                D  41-

205           SUBROUTINE RECHD                                                   E   1
      C       THIS SUBROUTINE RECALLS PREVIOUSLY COMPUTED AND PUNCHED            E   2
      C       HYDROGRAPHS                                                        E   3
206           COMMON CFS(300),OCFS(300,6),IEND(6),DATA(310),DA(6),DP(20),NPU,NHD  E   4
             1,SCFS(20),C(20),A(20,6),Q(20,6),RAIN(200),DEEP(20,6),NER,MAXNO,NCO  E   5
             2MM,ICC,NCODE,DIST(6),SEGN(6),CTBLE(50,11),ITBLE(50,2),ZALFA(20),DT  E   6
             3(6),TIME,PEAK(6),ROIN,ISG(6)                                       E   7
207           ID=DATA(1)                                                         E   8
208           NHD=DATA(2)                                                        E   9
209           DT(ID)=DATA(3)                                                     E  10
210           DA(ID)=DATA(4)                                                     E  11
211           PEAK(ID)=DATA(5)                                                   E  12
212           ROIN=DATA(6)                                                       E  13
213           IEND(ID)=DATA(7)                                                   E  14
214           M=IEND(ID)                                                         E  15
215           J=8                                                                E  16
```

```
      C     REMAINING DATA ARE FLOW RATES                                    E  17
216           DO 1 I=1,M                                                       E  18
217           OCFS(I,ID)=DATA(J)                                               E  19
218     1     J=J+1                                                            E  20
219           RETURN                                                           E  21
220           END                                                              E  22-

221           SUBROUTINE CMPHYD                                                F   1
      C     THIS PROGRAM DEVELOPS A UNIT HYDROGRAPH, CONVERTS MASS RAINFALL    F   2
      C     TO POINT RUNOFF, AND COMPUTES STORM HYDROGRAPHS BY SUMMATION.      F   3
222           COMMON CFS(300),OCFS(300,6),IEND(6),DATA(310),DA(6),DP(20),NPU,NHD  F   4
     1,SCFS(20),C(20),A(20,6),Q(20,6),RAIN(200),DEEP(20,6),NER,MAXNO,NCO  F   5
     2MM,ICC,NCODE,DIST(6),SEGN(6),CTBLE(50,11),ITBLE(50,2),ZALFA(20),DT  F   6
     3(6),TIME,PEAK(6),ROIN,ISG(6)                                        F   7
223           ID=DATA(1)                                                       F   8
224           NHD=DATA(2)                                                      F   9
225           DT(ID)=DATA(3)                                                   F  10
226           DA(ID)=DATA(4)                                                   F  11
227           CN=DATA(5)                                                       F  12
      C     ARE K AND TP FURNISHED OR WILL THEY BE COMPUTED                    F  13
228           IF (DATA(6)) 1,2,2                                               F  14
229     1     XK=-DATA(6)                                                      F  15
230           TP=-DATA(7)                                                      F  16
231           GO TO 3                                                          F  17
232     2     HT=DATA(6)                                                       F  18
233           XL=DATA(7)                                                       F  19
234           SLOPE=HT/XL                                                      F  20
235           XLDW=(XL**2.)/DA(ID)                                             F  21
236           XK=27.0*(DA(ID)**.231)*(SLOPE**(-.777))*(XLDW**.124)             F  22
237           TP=4.63*(DA(ID)**.422)*(SLOPE**(-.46))*(XLDW**.133)              F  23
238     3     PEAK(ID)=1.                                                      F  24
239           DO 4 I=1,300                                                     F  25
240     4     OCFS(I,ID)=0.                                                    F  26
      C     COMPUTE N BY ITERATION.                                            F  27
241           XN=5.0                                                           F  28
242           XKTP=XK/TP                                                       F  29
243           DO 6 I=1,50                                                      F  30
244           TINF=1.+SQRT(1./(XN-1.))                                         F  31
245           XN1=.05/(XKTP*(ALOG(TINF/(TINF+.05))+.05))+1.                    F  32
246           DIFF=ABS(XN1-XN)                                                 F  33
247           IF (DIFF-.001) 7,7,5                                             F  34
248     5     XN=XN1                                                           F  35
249     6     CONTINUE                                                         F  36
250           WRITE (6,29)                                                     F  37
251           GO TO 28                                                         F  38
      C     DETERMINE C1.                                                      F  39
252     7     DELT=TINF/100.                                                   F  40
253           TC1=0.                                                           F  41
254           XN1P=XN-1.                                                       F  42
255           XN1M=1.-XN                                                       F  43
256           DO 8 I=2,101                                                     F  44
257           TC1=TC1+DELT                                                     F  45
258     8     CFS(I)=(TC1**XN1P)*EXP(XN1M*(TC1-1.))                            F  46
259           SUM=CFS(101)/2.                                                  F  47
260           DO 9 I=2,100                                                     F  48
261     9     SUM=SUM+CFS(I)                                                   F  49
262           C1=SUM*DELT                                                      F  50
263           CFSII=CFS(101)                                                   F  51
264           TTINF=TINF*TP                                                    F  52
265           TREC1=TTINF+2.*XK                                                F  53
```

```
266             EEE=EXP((TTINF-TREC1)/XK)                                       F  54
267             XK1=3.*XK                                                       F  55
268             B=645.333/(C1+CFSII*(XKTP*(1.-EEE)+EEE*(XK1/TP)))               F  56
      C         COMPUTE B, QP, AND CFSI.                                        F  57
269             QP=(B*DA(ID))/TP                                                F  58
270             CFSI=QP*CFS(101)                                                F  59
271             CFSR1=CFSI*EEE                                                  F  60
272             WRITE (6,30) XN,QP                                              F  61
      C         DETERMINE INCREMENTAL RUNOFF.                                   F  62
273             R=1000./CN-10.                                                  F  63
274             B1=.2*R                                                         F  64
275             J=8                                                             F  65
276             IF (DATA(J)) 13,10,10                                           F  66
277   10        RAIN(1)=DATA(J)                                                 F  67
278             DO 11 I=2,300                                                   F  68
279             J=J+1                                                           F  69
280             RAIN(I)=DATA(J)                                                 F  70
281             IF (RAIN(I)-RAIN(I-1)) 12,11,11                                 F  71
282   11        CONTINUE                                                        F  72
283   12        NUMB=I-1                                                        F  73
284   13        DO 15 I=1,NUMB                                                  F  74
285             IF (RAIN(I)-B1) 33,33,14                                        F  75
286   33        DATA (I)=0.                                                     F  76
287             Q1=0.                                                           F  77
288             GO TO 15                                                        F  78
289   14        Q2=((RAIN(I)-B1)**2.)/(RAIN(I)+.8*R)                            F  79
290             DATA (I)=Q2-Q1                                                  F  80
291             Q1=Q2                                                           F  81
292   15        CONTINUE                                                        F  82
      C         COMPUTE UNIT HYDROGRAPH.                                        F  83
293             T2=0.                                                           F  84
294             CFS(1)=0.                                                       F  85
295             DO 20 I=2,300                                                   F  86
296             T2=T2+DT(ID)                                                    F  87
297             IF (T2-TTINF) 16,16,17                                          F  88
298   16        CFS(I)=QP*((T2/TP)**XN1P)*EXP(XN1M*(T2/TP-1.))                  F  89
299             GO TO 20                                                        F  90
300   17        IF (T2-TREC1) 18,18,19                                          F  91
301   18        CFS(I)=CFSI*EXP((TTINF-T2)/XK)                                  F  92
302             GO TO 20                                                        F  93
303   19        CFS(I)=CFSR1*EXP((TREC1-T2)/XK1)                                F  94
304             IF (CFS(I)-1.) 21,21,20                                         F  95
305   20        CONTINUE                                                        F  96
306             I=300                                                           F  97
307   21        ICND=I                                                          F  98
      C         COMPUTE STORM HYDROGRAPH.                                       F  99
308             DO 24 J=2,NUMB                                                  F 100
309             N=J+ICND-2                                                      F 101
310             IF (N-300) 23,23,22                                             F 102
311   22        N=300                                                           F 103
312   23        KK=J                                                            F 104
313             I=2                                                             F 105
314             DO 24 K=KK,N                                                    F 106
315             OCFS(K,ID)=OCFS(K,ID)+DATA(J)*CFS(I)                            F 107
316   24        I=I+1                                                           F 108
317             M=K-1                                                           F 109
318             RO=0.                                                           F 110
319             DO 26 I=2,M                                                     F 111
      C         COMPUTE RUNOFF VOLUME                                           F 112
320             RO=RO+OCFS(I,ID)                                                F 113
```

```
      C     DETERMINE PEAK                                                    F 114
321           IF (QCFS(I,ID)-PEAK(ID)) 26,26,25                               F 115
322   25      PEAK(ID)=QCFS(I,ID)                                             F 116
323   26      CONTINUE                                                        F 117
324           I=M                                                             F 118
325           IEND(ID)=I                                                      F 119
326           M=I                                                             F 120
327           ROIN=(RO*DT(ID))/(DA(ID)*645.333)                               F 121
      C     PUNCH CODE                                                      F 122
328           IF (NPU) 28,28,27                                               F 123
329   27      WRITE (7,31) ID,NHD,DT(ID),DA(ID),PEAK(ID),ROIN,IEND(ID)        F 124
330           WRITE (7,32) (QCFS(I,ID),I=1,M)                                 F 125
331   28      RETURN                                                          F 126
      C                                                                     F 127
332   29      FORMAT('N DID NOT CONVERGE AFTER 50 ITERATIONS.')               F 128
333   30      FORMAT(T10,'SHAPE CONSTANT, N = ',F6.3/T10,'UNIT PEAK = ',F10.1,'C F 129
     1FS'/)
334   31      FORMAT(   'RECALL HYD',T21,'ID=',I1,T29,'HYD NO=',I3,T42,'DT=',F9. F 130
     16,' HRS',T61,'DA=',F8.3,' SQ MI'/T21,'PEAK=',F7.0,'CFS',T40,'RO=',     F 131
     2F6.3,' INCHES',T59,'NO PTS=',I3/T21,'FLOW RATES')                      F 132
335   32      FORMAT (T21,7F8.0)                                              F 133
336           END                                                             F 134-

337           SUBROUTINE PRTHYD                                               G   1
      C     THIS SUBROUTINE PRINTS THE COORDINATES OF A HYDROGRAPH.           G   2
338           COMMON CFS(300),QCFS(300,6),IEND(6),DATA(310),DA(6),DP(20),NPU,NHD G   3
     1,SCFS(20),C(20),A(20,6),Q(20,6),RAIN(200),DEEP(20,6),NER,MAXNO,NCO      G   4
     2MM,ICC,NCODE,DIST(6),SEGN(6),CTBLE(50,11),ITBLE(50,2),ZALFA(20),DT     G   5
     3(6),TIME,PEAK(6),ROIN,ISG(6)                                           G   6
339           ID=DATA(1)                                                      G   7
340           NPK=DATA(2)                                                     G   8
      C     DETERMINE TYPE OF HYDROGRAPH                                    G   9
341           IF (NHD-100) 6,6,2                                              G  10
342   1       WRITE (6,14) NHD                                                G  11
343           GO TO 7                                                         G  12
344   2       IF (NHD-300) 3,3,4                                              G  13
345   3       WRITE (6,15) NHD                                                G  14
346           GO TO 7                                                         G  15
347   4       IF (NHD-500) 1,1,5                                              G  16
348   5       WRITE (6,16) NHD                                                G  17
349           GO TO 7                                                         G  18
350   6       WRITE (6,17) NHD                                                G  19
      C     POSITIVE NPK MEANS PRINT ONLY PEAK AND VOLUME                   G  20
351   7       IF (NPK) 8,8,11                                                 G  21
352   8       J=0                                                             G  22
353           WRITE (6,18)                                                    G  23
354           M=IEND(ID)                                                      G  24
355           TIME1=TIME                                                      G  25
      C     BUILD TIME ARRAY IN DATA                                        G  26
356           DO 9 I=1,M                                                      G  27
357           DATA (I)=TIME1                                                  G  28
358   9       TIME1=TIME1+DT(ID)                                              G  29
359           M4=M+4                                                          G  30
360           M5=M4/5                                                         G  31
361   10      J=J+1                                                           G  32
362           WRITE (6,19) (DATA(I),QCFS(I,ID),I=J,M,M5)                      G  33
363           IF (J-M5) 10,11,11                                              G  34
364   11      WRITE (6,20) ROIN,PEAK(ID)                                      G  35
365           IF (NPU) 13,13,12                                               G  36
366   12      WRITE (7,21) ID,NPK                                             G  37
```

```
367   13    RETURN                                                                G  38
      C                                                                           G  39
368   14    FORMAT (1HO,46X,21HHYDROGRAPH FROM AREA ,I3/)                         G  40
369   15    FORMAT (1HO,41X,19HPARTIAL HYDROGRAPH ,I4/)                           G  41
370   16    FORMAT (1HO,39X,29HOUTFLOW HYDROGRAPH RESERVOIR ,I4/)                 G  42
371   17    FORMAT (1HO,44X,25HOUTFLOW HYDROGRAPH REACH ,I4/)                     G  43
372   18    FORMAT (10X,114HTIME      FLOW           TIME      FLOW               G  44
           1TIME      FLOW           TIME      FLOW           TIME      FLOW/1   G  45
           21X,113HHRS       CFS            HRS       CFS            HRS       G  46
           3 CFS           HRS       CFS            HRS       CFS)              G  47
373   19    FORMAT (5(5X,F10.3,F10.0))                                            G  48
374   20    FORMAT (1HO,9X,16HRUNOFF VOLUME = F10.3,8H INCHES /10X,22HPEAK DIS    G  49
           1CHARGE RATE = ,F10.1,4H CFS///)                                      G  50
375   21    FORMAT(   'PRINT HYD',T21,'ID=',I1,T29,'CODE=',I1)                    G  51
376         END                                                                   G  52-

377         SUBROUTINE PUHYD                                                      H   1
      C     THIS SUBROUTINE PUNCHES HYDROGRAPHS IN FORM TO BE USED BY             H   2
      C     SUBROUTINE RECHD                                                      H   3
378         COMMON CFS(300),OCFS(300,6),IEND(6),DATA(310),DA(6),DP(20),NPU,NHD    H   4
           1,SCFS(20),C(20),A(20,6),Q(20,6),RAIN(200),DEEP(20,6),NER,MAXNO,NCO   H   5
           2MM,ICC,NCODE,DIST(6),SEGN(6),CTBLE(50,11),ITBLE(50,2),ZALFA(20),DT   H   6
           3(6),TIME,PEAK(6),ROIN,ISG(6)                                         H   7
379         ID=DATA(1)                                                            H   8
380         M=IEND(ID)                                                            H   9
381         WRITE (7,1) ID,NHD,DT(ID),DA(ID),PEAK(ID),ROIN,IEND(ID)               H  10
382         WRITE (7,2) (OCFS(I,ID),I=1,M)                                        H  11
383         RETURN                                                                H  12
      C                                                                           H  13
384   1     FORMAT(   'RECALL HYD',T21,'ID=',I1,T29,'HYD NO=',I3,T42,'DT=',F9.    H  14
           16,' HRS',T61,'DA=',F8.3,' SQ MI'/T21,'PEAK=',F7.0,'CFS',T40,'RO=',   H  15
           2F6.3,' INCHES',T59,'NO PTS=',I3/T21,'FLOW RATES')                    H  16
385   2     FORMAT (T21,7F8.0)                                                    H  17
386         END                                                                   H  18-

387         SUBROUTINE HPLOT                                                      I   1
      C     THIS SUBROUTINE PLOTS EITHER 1 OR 2 HYDROGRAPHS ON A SET OF AXIS      I   2
388         COMMON CFS(300),OCFS(300,6),IEND(6),DATA(310),DA(6),DP(20),NPU,NHD     I   3
           1,SCFS(20),C(20),A(20,6),Q(20,6),RAIN(200),DEEP(20,6),NER,MAXNO,NCO   I   4
           2MM,ICC,NCODE,DIST(6),SEGN(6),CTBLE(50,11),ITBLE(50,2),ZALFA(20),DT   I   5
           3(6),TIME,PEAK(6),ROIN,ISG(6)                                         I   6
389         ID1=DATA(1)                                                           I   7
390         ID2=DATA(2)                                                           I   8
391         DATA ZERO, PLUS, BLANK, DASH, DOT/'0','+',' ','-','.'/                I   9
392         MRTO=1                                                                I  10
393         XMRTO=1.                                                              I  11
394         MAX=118                                                               I  12
395         J=1                                                                   I  13
      C     ARE THERE 1 OR 2 HYDROGRAPHS                                          I  14
396         IF (ID2) 1,1,2                                                        I  15
      C     DETERMINE HIGHEST PEAK IF 2 HYDROGRAPHS                               I  16
397   1     QMAX=PEAK(ID1)                                                        I  17
398         GO TO 14                                                              I  18
399   2     IF (PEAK(ID1)-PEAK(ID2)) 3,3,4                                        I  19
400   3     QMAX=PEAK(ID2)                                                        I  20
401         GO TO 5                                                               I  21
402   4     QMAX=PEAK(ID1)                                                        I  22
      C     IF 2 HYDROGRAPHS DETERMINE LARGEST DT AND INTERPOLATE OTHER           I  23
      C     HYDROGRAPH IF NECESSARY                                               I  24
403   5     IF (DT(ID1)-DT(ID2)) 6,13,7                                           I  25
```

```
404    6      L=ID1                                                                I  26
405           K=ID2                                                                I  27
406           GO TO 8                                                              I  28
407    7      L=ID2                                                                I  29
408           K=ID1                                                                I  30
409    8      M=IEND(L)                                                            I  31
410           TID=DT(K)                                                            I  32
411           TIDH=0.                                                              I  33
412           DO 11 I=2,M                                                          I  34
413           TIDH=TIDH+DT(L)                                                      I  35
414           IF (TID-TIDH) 10,9,11                                                I  36
415    9      J=J+1                                                                I  37
416           CFS(J)=OCFS(I,L)                                                     I  38
417           TID=TID+DT(K)                                                        I  39
418           GO TO 11                                                             I  40
419    10     J=J+1                                                                I  41
420           CFS(J)=OCFS(I-1,L)+((TID-TIDH+DT(L))/DT(L))*(OCFS(I,L)-OCFS(I-1,L)   I  42
              1)                                                                   I  43
421           TID=TID+DT(K)                                                        I  44
422    11     CONTINUE                                                             I  45
423           IEND(L)=J                                                            I  46
424           DT(L)=DT(K)                                                          I  47
425           DO 12 I=2,J                                                          I  48
426    12     OCFS(I,L)=CFS(I)                                                     I  49
427    13     IF (IEND(ID1)-IEND(ID2)) 14,14,15                                    I  50
428    14     M=IEND(ID1)                                                          I  51
429           GO TO 16                                                             I  52
430    15     M=IEND(ID2)                                                          I  53
431    16     IF (M-MAX) 17,17,18                                                  I  54
       C      DETERMINE TIME SCALE                                                 I  55
432    17     MRTO=MAX/M                                                           I  56
433           XMRTO=MRTO                                                           I  57
434           GO TO 19                                                             I  58
435    18     M=MAX                                                                I  59
436    19     YSCL=QMAX/50.                                                        I  60
       C      PLOT HYDROGRAPHS                                                     I  61
437           DO 20 I=1,MAX                                                        I  62
438    20     CFS(I)=DASH                                                          I  63
439           WRITE (6,41) QMAX,(CFS(I),I=1,MAX),DOT                               I  64
440           Q1=QMAX                                                              I  65
441           J1=10                                                                I  66
442           DO 37 J=1,50                                                         I  67
443           IF (J-J1) 23,21,23                                                   I  68
444    21     DO 22 I=1,MAX                                                        I  69
445    22     CFS(I)=DASH                                                          I  70
446           GO TO 25                                                             I  71
447    23     DO 24 I=1,MAX                                                        I  72
448    24     CFS(I)=BLANK                                                         I  73
449    25     Q2=Q1-YSCL                                                           I  74
450           K=1                                                                  I  75
451           DO 28 I=2,M                                                          I  76
452           K=K+MRTO                                                             I  77
453           IF (OCFS(I,ID1)-Q1) 26,27,28                                         I  78
454    26     IF (OCFS(I,ID1)-Q2) 28,28,27                                         I  79
455    27     CFS(K)=ZERO                                                          I  80
456    28     CONTINUE                                                             I  81
457           WRITE (6,44) DOT,(CFS(I),I=1,MAX),DOT                                I  82
458           IF (ID2) 34,34,29                                                    I  83
459    29     K=1                                                                  I  84
460           DO 33 I=2,M                                                          I  85
```

```
461           K=K+MRTO                                                          I  86
462           IF (OCFS(I,ID2)-Q1) 30,31,32                                      I  87
463     30    IF (OCFS(I,ID2)-Q2) 32,32,31                                      I  88
464     31    CFS(K)=PLUS                                                       I  89
465           GO TO 33                                                          I  90
466     32    CFS(K)=BLANK                                                      I  91
467     33    CONTINUE                                                          I  92
468           WRITE (6,42) (CFS(I),I=1,MAX)                                     I  93
469     34    IF (J-J1) 36,35,36                                                I  94
470     35    J1=J1+10                                                          I  95
471           WRITE (6,43) Q2                                                   I  96
472     36    Q1=Q2                                                             I  97
473     37    CONTINUE                                                          I  98
474           CFS(1)=TIME                                                       I  99
475           DTT=DT(ID1)*10./XMRTO                                             I 100
        C     PUT TIME ARRAY IN CFS AND WRITE TIME SCALE                        I 101
476           DO 38 I=2,12                                                      I 102
477     38    CFS(I)=CFS(I-1)+DTT                                               I 103
478           WRITE (6,45) (CFS(I),I=1,12)                                      I 104
479           WRITE (6,46)                                                      I 105
480           IF (NPU) 40,40,39                                                 I 106
481     39    WRITE (7,47) ID1,ID2                                              I 107
482     40    RETURN                                                            I 108
        C                                                                       I 109
483     41    FORMAT(1X,F6.0,' CFS.',119A1)                                     I 110
484     42    FORMAT (1H+,11X,118A1)                                            I 111
485     43    FORMAT (1H+,F6.0)                                                 I 112
486     44    FORMAT (11X,120A1)                                                I 113
487     45    FORMAT (6X,12F10.3)                                               I 114
488     46    FORMAT(49X,'TIME HOURS'///)                                       I 115
489     47    FORMAT(   'PLOT HYD',T21,'ID I=',I1,T29,'ID II=',I1)              I 116
490           END                                                               I 117-

491           SUBROUTINE ADHYD                                                  J   1
        C     THIS SUBROUTINE ADDS TWO HYDROGRAPHS.                             J   2
492           COMMON CFS(300),OCFS(300,6),IEND(6),DATA(310),DA(6),DP(20),NPU,NHD J   3
             1,SCFS(20),C(20),A(20,6),Q(20,6),RAIN(200),DEEP(20,6),NER,MAXNO,NCO J   4
             2MM,ICC,NCODE,DIST(6),SEGN(6),CTBLE(50,11),ITBLE(50,2),ZALFA(20),DT J   5
             3(6),TIME,PEAK(6),ROIN,ISG(6)                                     J   6
493           ID=DATA(1)                                                        J   7
494           NHD=DATA(2)                                                       J   8
495           ID1=DATA(3)                                                       J   9
496           ID2=DATA(4)                                                       J  10
497           PEAK(ID)=1.                                                       J  11
        C     MAKE TIME INCREMENTS EQUAL IF NOT EQUAL. USE SMALLER INCREMENT    J  12
498           IF (DT(ID1)-DT(ID2)) 1,3,2                                        J  13
499     1     DT(ID)=DT(ID1)                                                    J  14
500           L=ID1                                                             J  15
501           K=ID2                                                             J  16
502           GO TO 6                                                           J  17
503     2     DT(ID)=DT(ID2)                                                    J  18
504           L=ID2                                                             J  19
505           K=ID1                                                             J  20
506           GO TO 6                                                           J  21
507     3     DT(ID)=DT(ID1)                                                    J  22
508           IF (IEND(ID1)-IEND(ID2)) 4,4,5                                    J  23
509     4     M3=IEND(ID1)                                                      J  24
510           K1=ID2                                                            J  25
511           IEND(ID)=IEND(ID2)                                                J  26
512           GO TO 18                                                          J  27
```

```
513   5     M3=IEND(ID2)
514         K1=ID1                                                          J  28
515         IEND(ID)=IEND(ID1)                                              J  29
516         GO TO 18                                                        J  30
      C     DETERMINE DURATIONS OF FLOW                                     J  31
517   6     XIEND1=IEND(ID1)-1                                              J  32
518         XIEND2=IEND(ID2)-1                                              J  33
519         DUR1=XIEND1*DT(ID1)                                             J  34
520         DUR2=XIEND2*DT(ID2)                                             J  35
521         IF (DUR1-DUR2) 7,8,8                                            J  36
522   7     IEND(ID)=DUR2/DT(ID)+1.                                         J  37
523         M3=DUR1/DT(ID)+1.                                               J  38
524         K1=ID2                                                          J  39
525         GO TO 9                                                         J  40
526   8     IEND(ID)=DUR1/DT(ID)+1.                                         J  41
527         M3=DUR2/DT(ID)+1.                                               J  42
528         K1=ID1                                                          J  43
529   9     IF (IEND(ID)-300) 11,11,10                                      J  44
530   10    IEND(ID)=300                                                    J  45
531   11    M2=IEND(K)                                                      J  46
532         J=1                                                             J  47
      C     INTERPOLATE ONE HYDROGRAPH IF NECESSARY                         J  48
533         TIDH=0.                                                         J  49
534         TID=DT(ID)                                                      J  50
535         DO 15 I=2,M2                                                    J  51
536         TIDH=TIDH+DT(K)                                                 J  52
537   12    IF (TIDH-TID) 15,13,14                                          J  53
538   13    J=J+1                                                           J  54
539         DATA (J)=OCFS(I,K)                                              J  55
540         TID=TID+DT(ID)                                                  J  56
541         IF (J-300) 15,16,16                                             J  57
542   14    J=J+1                                                           J  58
543         DATA (J)=OCFS(I-1,K)+((TID-TIDH+DT(K))/DT(K))*(OCFS(I,K)-OCFS(I-1,  J  59
          1K))                                                              J  60
544         TID=TID+DT(ID)                                                  J  61
545         IF (J-300) 12,16,16                                             J  62
546   15    CONTINUE                                                        J  63
547   16    IEND(K)=J                                                       J  64
548         DO 17 I=2,J                                                     J  65
549   17    OCFS(I,K)=DATA(I)                                               J  66
550   18    M=IEND(ID)                                                      J  67
551         DA(ID)=DA(ID1)+DA(ID2)                                          J  68
552         RO=0.                                                           J  69
      C     ADD HYDROGRAPHS                                                 J  70
553         DO 20 I=1,M3                                                    J  71
554         OCFS(I,ID)=OCFS(I,ID1)+OCFS(I,ID2)                              J  72
555         IF (OCFS(I,ID)-PEAK(ID)) 20,20,19                               J  73
556   19    PEAK(ID)=OCFS(I,ID)                                             J  74
557   20    RO=RO+OCFS(I,ID)                                                J  75
558         IF (PEAK(ID)-PEAK(K1)) 21,22,22                                 J  76
559   21    PEAK(ID)=PEAK(K1)                                               J  77
560   22    IF (M-M3) 25,25,23                                              J  78
561   23    M3=M3+1                                                         J  79
562         DO 24 I=M3,M                                                    J  80
563         OCFS(I,ID)=OCFS(I,K1)                                           J  81
564   24    RO=RO+OCFS(I,ID)                                                J  82
565   25    ROIN=(RO*DT(ID))/(DA(ID)*645.333)                               J  83
566         IF (NPU) 27,27,26                                               J  84
567   26    WRITE (7,28) ID,NHD,ID1,ID2                                     J  85
568   27    RETURN                                                          J  86
                                                                            J  87
```

```
      C                                                                      J  88
569   28    FORMAT(   'ADD HYD',T21,'ID=',I1,T29,' HYD NO=',I3,T45,'ID I=',I1,  J  89
           1T60,'ID II=',I1)                                                  J  90
570         END                                                              J  91-

571         SUBROUTINE SRC                                                   K   1
      C     THIS SUBROUTINE STORES AN ELEVATION - END AREA - FLOW TABLE.     K   2
572         COMMON CFS(300),OCFS(300,6),IEND(6),DATA(310),DA(6),DP(20),NPU,NHD K   3
           1,SCFS(20),C(20),A(20,6),Q(20,6),RAIN(200),DEEP(20,6),NER,MAXNO,NCO K   4
           2MM,ICC,NCODE,DIST(6),SEGN(6),CTBLE(50,11),ITBLE(50,2),ZALFA(20),DT K   5
           3(6),TIME,PEAK(6),ROIN,ISG(6)                                     K   6
573         ID=DATA(1)                                                       K   7
574         VS=DATA(2)                                                       K   8
      C     VALLEY SECTION NUMBER                                            K   9
      C     REMAINING DATA ARE ELEVATION, AREA, AND FLOW FOR EACH POINT OF   K  10
      C     THE RATING CURVE                                                 K  11
575         EMIN=DATA(3)                                                     K  12
576         J=3                                                              K  13
577         DO 1 I=1,20                                                      K  14
578         ELEV=DATA(J)                                                     K  15
579         DEEP(I,ID)=DATA(J)-EMIN                                          K  16
580         A(I,ID)=DATA(J+1)                                                K  17
581         Q(I,ID)=DATA(J+2)                                                K  18
582         J=J+3                                                            K  19
583   1     CONTINUE                                                         K  20
584         RETURN                                                           K  21
585         END                                                              K  22-

586         SUBROUTINE CMPRC                                                 L   1
      C     THIS SUBROUTINE COMPUTES THE DISCHARGE END-AREA ELEVATION        L   2
      C     RELATIONSHIP FOR A VALLEY SECTION.                               L   3
587         COMMON CFS(300),OCFS(300,6),IEND(6),DATA(310),DA(6),DP(20),NPU,NHD L   4
           1,SCFS(20),C(20),A(20,6),Q(20,6),RAIN(200),DEEP(20,6),NER,MAXNO,NCO L   5
           2MM,ICC,NCODE,DIST(6),SEGN(6),CTBLE(50,11),ITBLE(50,2),ZALFA(20),DT L   6
           3(6),TIME,PEAK(6),ROIN,ISG(6)                                    L   7
588         ID=DATA(1)                                                       L   8
      C     STORAGE LOCATION NUMBER. (1-6)                                   L   9
589         VS=DATA(2)                                                       L  10
      C     VALLEY SECTION IDENTIFICATION NUMBER.                            L  11
590         NSEG=DATA(3)                                                     L  12
      C     NUMBER OF SEGMENTS IN THE VALLEY SECTION.                        L  13
591         ELO=DATA(4)                                                      L  14
592         EMAX=DATA(5)                                                     L  15
      C     MAXIMUM ELEVATION FOR COMPUTATIONS.                              L  16
593         SLOPE1=DATA(6)                                                   L  17
      C     CHANNEL SLOPE.                                                   L  18
594         SLOPE2=DATA(7)                                                   L  19
      C     FLOOD PLAIN SLOPE.                                               L  20
595         DIF=(EMAX-ELO)/19.                                               L  21
596         C(1)=ELO                                                         L  22
597         DO 1 I=2,20                                                      L  23
598   1     C(I)=C(I-1)+DIF                                                  L  24
      C     SET AREA AND DISCHARGE ARRAYS = 0.                               L  25
599         DO 2 I=1,20                                                      L  26
600         A(I,ID)=0.                                                       L  27
601   2     Q(I,ID)=0.                                                       L  28
602         J=8                                                              L  29
603         WRITE (6,24) VS                                                  L  30
      C     READ N VALUES AND SEGMENT BORDER POINTS.                         L  31
604         DO 3 I=1,NSEG                                                    L  32
```

```
605           SEGN(I)=DATA(J)
606           DIST(I)=DATA(J+1)                                          L  33
607     3     J=J+2                                                      L  34
      C       REMAINING DATA ITEMS ARE DISTANCES AND ELEVATIONS.         L  35
608           JJJ=J                                                      L  36
609           DO 6 I=1,NSEG                                              L  37
610     4     J=J+2                                                      L  38
611           IF (DATA(J)-DIST(I)) 4,5,5                                 L  39
612     5     ISG(I)=J+1                                                 L  40
613     6     CONTINUE                                                   L  41
      C       COMPUTE DISCHARGES AND END AREAS FOR EACH SEGMENT.         L  42
614           DO 22 K=1,NSEG                                             L  43
615           J=JJJ                                                      L  44
616           JJJ1=JJJ+1                                                 L  45
617           IF (SEGN(K)) 7,7,8                                         L  46
618     7     SLOPE=SLOPE1                                               L  47
619           SEGN(K)=-SEGN(K)                                           L  48
620           GO TO 9                                                    L  49
621     8     SLOPE=SLOPE2                                               L  50
622     9     SLPN=1.486*SLOPE**.5                                       L  51
      C       COMPUTE AREA AND DISCHARGE FOR SEGMENT.                    L  52
623           DO 21 I=2,20                                               L  53
624           AA=0.                                                      L  54
625           P=0.                                                       L  55
626           J=JJJ-1                                                    L  56
627           DEP2=0.                                                    L  57
628     10    J=J+2                                                      L  58
629           IF (J-ISG(K)) 12,12,11                                     L  59
630     11    IF (AA-.001) 21,21,20                                      L  60
631     12    IF (DATA(J)-C(I)) 13,10,10                                 L  61
632     13    DEP1=C(I)-DATA(J)                                          L  62
633           IF (J-JJJ1) 16,16,14                                       L  63
634     14    XL=DATA(J-1)-DATA(J-3)                                     L  64
635           DEP3=ABS(DATA(J-2)-DATA(J))                                L  65
636           XL=XL*DEP1/DEP3                                            L  66
637     15    AA=AA+XL*(DEP1+DEP2)/2.                                    L  67
638           P=P+SQRT((DEP1-DEP2)**2+XL**2)                             L  68
639     16    DEP2=DEP1                                                  L  69
640           J=J+2                                                      L  70
641           IF (J-ISG(K)) 17,17,20                                     L  71
642     17    IF (DATA(J)-C(I)) 18,18,19                                 L  72
643     18    DEP1=C(I)-DATA(J)                                          L  73
644           XL=DATA(J-1)-DATA(J-3)                                     L  74
645           GO TO 15                                                   L  75
646     19    DEP1=0.                                                    L  76
647           XL=DATA(J-1)-DATA(J-3)                                     L  77
648           DEP3=ABS(DATA(J-2)-DATA(J))                                L  78
649           XL=XL*DEP2/DEP3                                            L  79
650           AA=AA+XL*(DEP1+DEP2)/2.                                    L  80
651           P=P+SQRT((DEP1-DEP2)**2+XL**2)                             L  81
652           DEP2=0.                                                    L  82
653           GO TO 10                                                   L  83
654     20    R=AA/P                                                     L  84
655           SGN=SEGN(K)-.0025*R                                        L  85
      C       ADD DISCHARGES AND AREAS FOR ALL SEGMENTS TO OBTAIN TOTALS FOR  L  86
      C       VALLEY SECTION.                                            L  87
656           Q(I,ID)=Q(I,ID)+AA*R**.66667*SLPN/SGN                      L  88
657           A(I,ID)=A(I,ID)+AA                                         L  89
658     21    CONTINUE                                                   L  90
659           JJJ=J-3                                                    L  91
                                                                         L  92
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```
660   22    CONTINUE                                                          L  93
661         DO 23 I=1,20                                                      L  94
662         DEEP(I,ID)=C(I)-ELO                                               L  95
663         WRITE (6,25) C(I),A(I,ID),Q(I,ID)                                 L  96
664   23    CONTINUE                                                          L  97
665         RETURN                                                            L  98
      C                                                                       L  99
666   24    FORMAT(1H0,T42,'RATING CURVE VALLEY SECTION',F5.1/T46,'WATER',T56, L 100
           1'FLOW',T66,'FLOW'/T45,'SURFACE',T56,'AREA',T66,'RATE'/T46,'ELEV',T L 101
           256,'SQ FT',T66,'CFS')                                             L 102
667   25    FORMAT (40X,F10.2,2F10.1)                                         L 103
668         END                                                               L 104-

669         SUBROUTINE STT                                                    M   1
      C     THIS SUBROUTINE STORES A DEPTH - FLOW - TRAVEL TIME TABLE.        M   2
670         COMMON CFS(300),QCFS(300,6),IEND(6),DATA(310),DA(6),DP(20),NPU,NHD M   3
           1,SCFS(20),C(20),A(20,6),Q(20,6),RAIN(200),DEEP(20,6),NER,MAXNO,NCO M   4
           2MM,ICC,NCODE,DIST(6),SEGN(6),CTBLE(50,11),ITBLE(50,2),ZALFA(20),DT M   5
           3(6),TIME,PEAK(6),ROIN,ISG(6)                                      M   6
671         ID=DATA(1)                                                        M   7
672         REACH=DATA(2)                                                     M   8
673         XL=DATA(3)                                                        M   9
674         SLOPE=DATA(4)                                                     M  10
675         DIST(ID)=SLOPE*XL                                                 M  11
676         J=5                                                               M  12
677         DO 1 I=1,19                                                       M  13
678         DP(I)=DATA(J)                                                     M  14
679         SCFS(I)=DATA(J+1)                                                 M  15
680         C(I)=DATA(J+2)                                                    M  16
681   1     J=J+3                                                             M  17
682         RETURN                                                            M  18
683         END                                                               M  19-

684         SUBROUTINE CMPTT                                                  N   1
      C     THIS SUBROUTINE COMPUTES THE TRAVEL TIME AT GIVEN                 N   2
      C     DISCHARGE RATES                                                   N   3
685         COMMON CFS(300),QCFS(300,6),IEND(6),DATA(310),DA(6),DP(20),NPU,NHD N   4
           1,SCFS(20),C(20),A(20,6),Q(20,6),RAIN(200),DEEP(20,6),NER,MAXNO,NCO N   5
           2MM,ICC,NCODE,DIST(6),SEGN(6),CTBLE(50,11),ITBLE(50,2),ZALFA(20),DT N   6
           3(6),TIME,PEAK(6),ROIN,ISG(6)                                      N   7
686         ID=DATA(1)                                                        N   8
687         REACH=DATA(2)                                                     N   9
688         NOVS=DATA(3)                                                      N  10
689         XL=DATA(4)                                                        N  11
690         SLOPE=DATA(5)                                                     N  12
691         DIST(ID)=SLOPE*XL                                                 N  13
692         XLD36=XL/3600.                                                    N  14
      C     ZERO ARRAYS                                                       N  15
693         DO 1 J=1,20                                                       N  16
694         DATA (J)=0.                                                       N  17
695   1     CFS(J)=0.                                                         N  18
696         ID1=1                                                             N  19
      C     FIND RATING CURVE WITH SMALLEST MAXIMUM FLOW RATE                 N  20
697   2     QMIN=Q(20,ID1)                                                    N  21
698         MIN=ID1                                                           N  22
699         GO TO 4                                                           N  23
700   3     ID1=ID1+1                                                         N  24
701         IF (QMIN-Q(20,ID1)) 4,4,2                                         N  25
702   4     IF (ID1-NOVS) 3,5,5                                               N  26
703   5     I=1                                                               N  27
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      C     SET SCFS ARRAY EQUAL TO Q ARRAY OF LOWEST RATING CURVE                N  28
704           DO 6 J=2,20                                                         N  29
705           SCFS(I)=Q(J,MIN)                                                    N  30
706     6     I=I+1                                                               N  31
      C     COMPUT END AREA AND DEPTH                                             N  32
707           DO 9 ID1=1,NOVS                                                     N  33
708           DO 9 J=1,19                                                         N  34
709           DO 7 I=2,20                                                         N  35
710           IF (Q(I,ID1)-SCFS(J)) 7,17,8                                        N  36
711     7     CONTINUE                                                            N  37
712     17    DATA(J)=A(I,ID1)+DATA(J)                                            N  38
713           CFS(J)=DEEP(I,ID1)+CFS(J)                                           N  39
714           GO TO 9                                                             N  40
715     8     XY=(SCFS(J)-Q(I-1,ID1))/(Q(I,ID1)-Q(I-1,ID1))                       N  41
716           DATA(J)=A(I-1,ID1)+XY*(A(I,ID1)-A(I-1,ID1))+DATA(J)                 N  42
717           CFS(J)=DEEP(I-1,ID1)+XY*(DEEP(I,ID1)-DEEP(I-1,ID1))+CFS(J)          N  43
718     9     CONTINUE                                                            N  44
719           XNOVS=NOVS                                                          N  45
720           WRITE (6,13) REACH                                                  N  46
      C     COMPUTE TRAVEL TIME                                                   N  47
721           DO 10 I=1,19                                                        N  48
722           AVAREA=DATA(I)/XNOVS                                                N  49
723           DP(I)=CFS(I)/XNOVS                                                  N  50
724           S=AVAREA*XLD36                                                      N  51
725           C(I)=S/SCFS(I)                                                      N  52
726           WRITE (6,14) DP(I),SCFS(I),C(I)                                     N  53
727     10    CONTINUE                                                            N  54
      C     PUNCH CODE                                                            N  55
728           IF (NPU) 12,12,11                                                   N  56
729     11    WRITE (7,15) ID,REACH,XL,SLOPE                                      N  57
730           WRITE (7,16) (DP(I),SCFS(I),C(I),I=1,19)                            N  58
731     12    RETURN                                                              N  59
      C                                                                         N  60
732     13    FORMAT(1HO,T46,'TRAVEL TIME TABLE'/T54,'REACH',F5.1//T46,'WATER',T  N  61
             156,'FLOW',T65,'TRAVEL'/T46,'DEPTH',T56,'RATE',T66,'TIME'/T46,'FEET  N  62
             2',T56,'CFS',T66,'HRS')                                             N  63
733     14    FORMAT (40X,F10.2,F10.0,F10.4)                                      N  64
734     15    FORMAT('STORE TRAVEL TIME',T21,'ID=',I1,T29,'REACH NO=',F5.1,T44,   N  65
             1'LENGTH=',F9.0,' FT'/T21,'SLOPE=',F8.6,'FT/FT'                /T2  N  66
             21,'DEPTH(FT)',T35,'FLOW(CFS)',T49,'TIME(HRS)')                     N  67
735     16    FORMAT (T21,F7.2,F15.0,F15.3)                                       N  68
736           END                                                                 N  69-
737           SUBROUTINE ROUTE
      C     THIS SUBROUTINE ROUTES A HYDROGRAPH THROUGH A REACH WITH THE          O   1
      C     NEW VSC METHOD OF FLOOD ROUTING. THIS METHOD ACCOUNTS FOR THE         O   2
      C     VARIATION IN WATER SURFACE SLOPE.                                     O   3
738           COMMON CFS(300),QCFS(300,6),IEND(6),DATA(310),DA(6),DP(20),NPU,NHD   O   4
             1,SCFS(20),C(20),A(20,6),Q(20,6),RAIN(200),DEEP(20,6),NER,MAXNO,NCO  O   5
             2MM,ICC,NCODE,DIST(6),SEGN(6),CTBLE(50,11),ITBLE(50,2),ZALFA(20),DT  O   6
             3(6),TIME,PEAK(6),ROIN,ISG(6)                                       O   7
739           ID=DATA(1)                                                          O   8
740           NHD=DATA(2)                                                         O   9
741           IDH=DATA(3)                                                         O  10
742           DT(ID)=DATA(4)                                                      O  11
743           DA(ID)=DA(IDH)                                                      O  12
744           M=IEND(IDH)                                                         O  13
      C     IF ID AND IDH ARE EQUAL, ADD 1 TO IDH                                 O  14
745           IF (ID-IDH) 3,1,3                                                   O  15
746     1     IDH=IDH+1                                                           O  16
                                                                                  O  17
```

```
747           DO 2 I=1,M
748     2     OCFS(I,IDH)=OCFS(I,IDH-1)
749           DT(IDH)=DT(IDH-1)
750           PEAK(IDH)=PEAK(IDH-1)
751     3     NERRT=0
752           PEAK(ID)=1.
753           RO=0.
754           N=19
755           OCFS(1,ID)=0.
756           S=0.
757           T1=C(1)
758           J=1
759           GUES=1.
760           CFS(1)=0.
      C     IF ROUTING INTERVAL IS NOT EQUAL TO TIME INCREMENT OF INFLOW
      C     HYDROGRAPH, INTERPOLATE
761           IF (DT(ID)-DT(IDH)) 8,15,4
762     4     TID=DT(ID)
763           TIDH=0.
764           DO 7 I=2,M
765           TIDH=TIDH+DT(IDH)
766           IF (TID-TIDH) 6,5,7
767     5     J=J+1
768           CFS(J)=OCFS(I,IDH)
769           TID=TID+DT(ID)
770           GO TO 7
771     6     J=J+1
772           CFS(J)=OCFS(I-1,IDH)+((TID-TIDH+DT(IDH))/DT(IDH))*(OCFS(I,IDH)-OC
             1S(I-1,IDH))
773           TID=TID+DT(ID)
774     7     CONTINUE
775           GO TO 13
776     8     TIDH=0.
777           TID=DT(ID)
778           DO 12 I=2,M
779           TIDH=TIDH+DT(IDH)
780     9     IF (TIDH-TID) 12,10,11
781     10    J=J+1
782           CFS(J)=OCFS(I,IDH)
783           TID=TID+DT(ID)
784           IF (J-300) 12,13,13
785     11    J=J+1
786           CFS(J)=OCFS(I-1,IDH)+((TID-TIDH+DT(IDH))/DT(IDH))*(OCFS(I,IDH)-OC
             1S(I-1,IDH))
787           TID=TID+DT(ID)
788           IF (J-300) 9,13,13
789     12    CONTINUE
790     13    IEND(IDH)=J
791           DT(IDH)=DT(ID)
792           M=J
793           DO 14 I=2,M
794     14    OCFS(I,IDH)=CFS(I)
      C     IF INFLOW IS ZERO, SO IS OUTFLOW
795     15    DO 16 L=2,M
796           IF (OCFS(L,IDH)) 16,16,49
797     16    OCFS(L,ID)=0.
      C     ROUTE
798     49    DATA (L-1)=0.
799           DO 42 I=L,300
800           IF (I-M) 18,18,17
```

```
801    17    OCFS(I,IDH)=OCFS(I-1,IDH)*.9
802    18    AVIN=(OCFS(I,IDH)+OCFS(I-1,IDH))/2.                    0  78
803          SIA=S+AVIN                                             0  79
804          J=1                                                    0  80
       C     DETERMINE DEPTH AND TRAVEL TIME OF INFLOW              0  81
805          IF (OCFS(I,IDH)-SCFS(1)) 19,23,20                      0  82
806    19    DI2=(OCFS(I,IDH)/SCFS(1))*DP(1)                        0  83
807          TI2=C(1)                                               0  84
808          GO TO 25                                               0  85
809    20    DO 21 J=2,N                                            0  86
810          IF (OCFS(I,IDH)-SCFS(J)) 24,23,21                      0  87
811    21    CONTINUE                                               0  88
812          IF (NERRT) 22,22,36                                    0  89
813    22    WRITE (6,46)                                           0  90
814          NERRT=1                                                0  91
815          GO TO 36                                               0  92
816    23    DI2=DP(J)                                              0  93
817          TI2=C(J)                                               0  94
818          GO TO 25                                               0  95
819    24    RATIO=(OCFS(I,IDH)-SCFS(J-1))/(SCFS(J)-SCFS(J-1))      0  96
820          DI2=DP(J-1)+RATIO*(DP(J)-DP(J-1))                      0  97
821          TI2=C(J-1)+RATIO*(C(J)-C(J-1))                         0  98
822    25    DO 35 IT=1,10                                          0  99
823          J=1                                                    0 100
       C     DETERMINE DEPTH AND TRAVEL TIME OF OUTFLOW             0 101
824          IF (GUES-SCFS(1)) 26,29,27                             0 102
825    26    DO2=(GUES/SCFS(1))*DP(1)                               0 103
826          TO2=C(1)                                               0 104
827          GO TO 31                                               0 105
828    27    DO 28 J=2,N                                            0 106
829          IF (GUES-SCFS(J)) 30,29,28                             0 107
830    28    CONTINUE                                               0 108
831          J=N                                                    0 109
832    29    DO2=DP(J)                                              0 110
833          TO2=C(J)                                               0 111
834          GO TO 31                                               0 112
835    30    RATIO=(GUES-SCFS(J-1))/(SCFS(J)-SCFS(J-1))             0 113
836          DO2=DP(J-1)+RATIO*(DP(J)-DP(J-1))                      0 114
837          TO2=C(J-1)+RATIO*(C(J)-C(J-1))                         0 115
       C     FIND WATER SURFACE SLOPE                               0 116
838    31    DDD=DIST(ID)/(DIST(ID)+DI2-DO2)                        0 117
839          IF (DDD-.01) 32,32,33                                  0 118
840    32    GUES=OCFS(I-1,IDH)                                     0 119
841          GO TO 35                                               0 120
842    33    T2=.5*(TI2+TO2)                                        0 121
843          T2=T2*SQRT(DDD)                                        0 122
844          T=T1+T2                                                0 123
       C     COMPUTE ROUTING COEFFICIENT                            0 124
845          COEF=(2.*DT(ID))/(T+DT(ID))                            0 125
846          O2=COEF*SIA                                            0 126
847          TRY1=GUES                                              0 127
848          RATIO=O2/(GUES+.1E-20)                                 0 128
849          DIFF=ABS(1.-RATIO)                                     0 129
       C     TEST FOR CONVERGENCE                                   0 130
850          IF (DIFF-.001) 37,37,34                                0 131
851    34    GUES=O2                                                0 132
852    35    CONTINUE                                               0 133
853          OCFS(I,ID)=DATA(I-1)*SIA                               0 134
854          DATA (I)=DATA(I-1)                                     0 135
855          WRITE (6,47) I,OCFS(I,ID)                              0 136
                                                                    0 137
```

```
856           GO TO 38                                                          O 138
857     36    OCFS(I,ID)=DATA(I-1)*SIA                                          O 139
858           DATA (I)=DATA(I-1)                                                O 140
859           GO TO 38                                                          O 141
860     37    OCFS(I,ID)=O2                                                     O 142
861           DATA (I)=COEF                                                     O 143
      C       COMPUTE NEW STORAGE                                               O 144
862     38    S=SIA-OCFS(I,ID)                                                  O 145
863           T1=T2                                                             O 146
864           RO=RO+OCFS(I,ID)                                                  O 147
865           IF (OCFS(I,ID)-OCFS(I-1,ID)) 39,40,40                             O 148
866     39    IF (OCFS(I,ID)-1.) 43,43,42                                       O 149
867     40    IF (OCFS(I,ID)-PEAK(ID)) 42,42,41                                 O 150
868     41    PEAK(ID)=OCFS(I,ID)                                               O 151
869     42    CONTINUE                                                          O 152
870           I=300                                                             O 153
871     43    IEND(ID)=I                                                        O 154
872           ROIN=(RO*DT(ID))/(DA(ID)*645.333)                                 O 155
      C       PUNCH CODE                                                        O 156
873           IF (NPU) 45,45,44                                                 O 157
874     44    WRITE (7,48) ID,NHD,IDH,DT(ID)                                    O 158
875     45    RETURN                                                            O 159
      C                                                                       O 160
876     46    FORMAT(1HO,'TRAVEL TIME TABLE EXCEEDED')                          O 161
877     47    FORMAT(T10,'PROBLEM FAILED TO CONVERGE AFTER10 ITERATIONS. CONVERG O 162
            1ENCE WAS FORCED.'/T20,'OUTFLOW NUMBER = ',I4,'RATE =',F10.2)       O 163
878     48    FORMAT(    'ROUTE',T21,'ID=',I1,T29,'HYD NO=',I3,T45,'INFLOW ID=',I O 164
            11,T65,'DT=',F8.6,'HRS')                                            O 165
879           END                                                               O 166-

880           SUBROUTINE RESVO                                                  P   1
      C       THIS SUBROUTINE ROUTES A HYDROGRAPH THROUGH A RESERVOIR WITH THE  P   2
      C       STORAGE-INDICATION METHOD.                                        P   3
881           COMMON CFS(300),OCFS(300,6),IEND(6),DATA(310),DA(6),DP(20),NPU,NHD P   4
            1,SCFS(20),C(20),A(20,6),Q(20,6),RAIN(200),DEEP(20,6),NER,MAXNO,NCO P   5
            2MM,ICC,NCODE,DIST(6),SEGN(6),CTBLE(50,11),ITBLE(50,2),ZALFA(20),DT P   6
            3(6),TIME,PEAK(6),ROIN,ISG(6)                                       P   7
882           ID=DATA(1)                                                        P   8
883           NHD=DATA(2)                                                       P   9
884           IDH=DATA(3)                                                       P  10
885           NERES=0                                                           P  11
886           DT(ID)=DT(IDH)                                                    P  12
887           RO=0.                                                             P  13
888           DA(ID)=DA(IDH)                                                    P  14
889           PEAK(ID)=1.                                                       P  15
890           J=1                                                               P  16
891           I=4                                                               P  17
      C       REMAINING DATA ARE FLOW AND STORAGE VALUES                        P  18
892           SCFS(J)=DATA(I)                                                   P  19
893           STORE1=DATA(I+1)*12.1                                             P  20
894           STORE=STORE1                                                      P  21
      C       COMPUTE STORAGE COEFFICIENT ARRAY C                               P  22
895     1     C(J)=(SCFS(J)/2.)+(STORE/DT(ID))                                  P  23
896           I=I+2                                                             P  24
897           J=J+1                                                             P  25
898           IF (J-20) 2,2,3                                                   P  26
899     2     SCFS(J)=DATA(I)                                                   P  27
900           STORE=DATA(I+1)*12.1                                              P  28
901           IF (SCFS(J)-.001) 3,3,1                                           P  29
902     3     N=J-1                                                             P  30
```

```
903           OCFS(1,ID)=0.
904           S=STORE1/DT(ID)                                                  P  31
      C       ROUTE                                                            P  32
905           DO 15 I=2,150                                                    P  33
906           IF (I-IEND(IDH)) 5,5,4                                           P  34
907     4     OCFS(I,IDH)=0.0                                                  P  35
908     5     AVIN=(OCFS(I,IDH)+OCFS(I-1,IDH))/2.                              P  36
909           SIA=S+AVIN                                                       P  37
      C       DETERMINE PROPER C                                               P  38
910           DO 6 J=1,N                                                       P  39
911           IF (SIA-C(J)) 10,9,6                                             P  40
912     6     CONTINUE                                                         P  41
913           IF (NERES) 7,7,8                                                 P  42
914     7     WRITE (6,19)                                                     P  43
915           NERES=1                                                          P  44
916     8     RESC=SCFS(N)/C(N)                                                P  45
      C       COMPUT OUTFLOW                                                   P  46
917           OCFS(I,ID)=RESC*SIA                                              P  47
918           GO TO 11                                                         P  48
919     9     OCFS(I,ID)=SCFS(J)                                               P  49
920           GO TO 11                                                         P  50
921     10    OCFS(I,ID)=SCFS(J-1)+((SIA-C(J-1))/(C(J)-C(J-1)))*(SCFS(J)-SCFS(J-  P  51
             11))                                                              P  52
      C       DETERMINE NEW STORAGE                                            P  53
922     11    S=SIA-OCFS(I,ID)                                                 P  54
923           RO=RO+OCFS(I,ID)                                                 P  55
924           IF (OCFS(I,ID)-OCFS(I-1,ID)) 12,13,13                            P  56
925     12    IF (OCFS(I,ID)-1.) 16,16,15                                      P  57
926     13    IF (OCFS(I,ID)-PEAK(ID)) 15,15,14                                P  58
927     14    PEAK(ID)=OCFS(I,ID)                                              P  59
928     15    CONTINUE                                                         P  60
929           I=150                                                            P  61
930     16    IEND(ID)=I                                                       P  62
931           ROIN=RO*DT(ID)/(DA(ID)*645.333)                                  P  63
      C       PUNCH CODE                                                       P  64
932           IF (NPU) 18,18,17                                                P  65
933     17    WRITE (7,20) ID,NHD,IDH                                          P  66
934           II=2*N+3                                                         P  67
935           WRITE (7,21) (DATA(I),I=5,II)                                    P  68
936     18    RETURN                                                           P  69
      C                                                                        P  70
937     19    FORMAT (1HO,33HSTORAGE-DISCHARGE TABLE EXCEEDED.)                P  71
938     20    FORMAT(    'ROUTE RESERVOIR',T21,'ID=',I1,T29,'HYD NO=',I3,T42,'INF  P  72
             1LOW ID=',I1                                  /T21,'OUTFLOW(CFS)',T37,'STOR  P  73
             2AGE(AC FT)')                                                    P  74
939     21    FORMAT (T21,F10.1,F13.1)                                         P  75
940           END                                                              P  75
                                                                               P  76-
941           SUBROUTINE ERROR
      C       THIS SUBROUTINE DETERMINES THE ERROR STANDARD DEVIATION AND THE  Q   1
      C       PEAK FLOW ERROR FOR 2 HYDROGRAPHS                                Q   2
942           COMMON CFS(300),OCFS(300,6),IEND(6),DATA(310),DA(6),DP(20),NPU,NHD  Q   3
             1,SCFS(20),C(20),A(20,6),Q(20,6),RAIN(200),DEEP(20,6),NER,MAXNO,NCO  Q   4
             2MM,ICC,NCODE,DIST(6),SEGN(6),CTBLE(50,11),ITBLE(50,2),ZALFA(20),DT  Q   5
             3(6),TIME,PEAK(6),ROIN,ISG(6)                                     Q   6
943           ID1=DATA(1)                                                      Q   7
944           ID2=DATA(2)                                                      Q   8
945           SSE=0.                                                           Q   9
946           WRITE (6,15)                                                     Q  10
947           J=1                                                              Q  11
                                                                               Q  12
```

```
      C     IF TIME INCREMENTS NOT EQUAL, INTERPOLATE                                  Q  13
  948       IF (DT(ID1)-DT(ID2)) 1,8,2                                                 Q  14
  949   1   L=ID1                                                                      Q  15
  950       K=ID2                                                                      Q  16
  951       GO TO 3                                                                    Q  17
  952   2   L=ID2                                                                      Q  18
  953       K=ID1                                                                      Q  19
  954   3   M=IEND(L)                                                                  Q  20
  955       TID=DT(K)                                                                  Q  21
  956       TIDH=0.                                                                    Q  22
  957       DO 6 I=2,M                                                                 Q  23
  958       TIDH=TIDH+DT(L)                                                            Q  24
  959       IF (TID-TIDH) 5,4,6                                                        Q  25
  960   4   J=J+1                                                                      Q  26
  961       CFS(J)=OCFS(I,L)                                                           Q  27
  962       TID=TID+DT(K)                                                              Q  28
  963       GO TO 6                                                                    Q  29
  964   5   J=J+1                                                                      Q  30
  965       CFS(J)=OCFS(I-1,L)+((TID-TIDH+DT(L))/DT(L))*(OCFS(I,L)-OCFS(I-1,L)         Q  31
           1)                                                                          Q  32
  966       TID=TID+DT(K)                                                              Q  33
  967   6   CONTINUE                                                                   Q  34
  968       IEND(L)=J                                                                  Q  35
  969       DT(L)=DT(K)                                                                Q  36
  970       DO 7 I=2,J                                                                 Q  37
  971   7   OCFS(I,L)=CFS(I)                                                           Q  38
  972   8   IF (IEND(ID1)-IEND(ID2)) 9,9,10                                            Q  39
  973   9   M=IEND(ID1)                                                                Q  40
  974       GO TO 11                                                                   Q  41
  975   10  M=IEND(ID2)                                                                Q  42
  976   11  T2=TIME                                                                    Q  43
      C     DETERMINE ERROR                                                            Q  44
  977       DO 12 I=1,M                                                                Q  45
  978       ERR=OCFS(I,ID1)-OCFS(I,ID2)                                                Q  46
  979       WRITE (6,16) T2,OCFS(I,ID1),OCFS(I,ID2),ERR                                Q  47
  980       T2=T2+DT(ID1)                                                              Q  48
      C     SUM OF SQUARES OF ERROR                                                    Q  49
  981   12  SSE=SSE+ERR*ERR                                                           Q  50
  982       XM=M                                                                       Q  51
      C     ERROR VARIANCE                                                             Q  52
  983       EVAR=SSE/XM                                                                Q  53
      C     ERROR STANDARD DEVIATION                                                   Q  54
  984       ESDEV=SQRT(EVAR)                                                           Q  55
  985       WRITE (6,17) ESDEV                                                         Q  56
      C     PERCENT ERROR FOR PEAK FLOWS                                               Q  57
  986       ERPK=ABS(PEAK(ID1)-PEAK(ID2))                                              Q  58
  987       PCTER=(ERPK/PEAK(ID1))*100.                                                Q  59
  988       WRITE (6,18) PCTER                                                         Q  60
      C     PUNCH CODE                                                                 Q  61
  989       IF (NPU) 14,14,13                                                          Q  62
  990   13  WRITE (7,19) ID1,ID2                                                       Q  63
  991   14  RETURN                                                                     Q  64
      C                                                                              Q  65
  992   15  FORMAT(1HO,T33,'TIME',T55,'FLOW 1',T76,'FLOW 2',T95,'ERROR'/T34,          Q  66
           1'HRS',T57,'CFS',T78,'CFS',T97,'CFS')                                     Q  67
  993   16  FORMAT (20X,F20.3,3F20.0)                                                  Q  68
  994   17  FORMAT(1HO,T10,'ERROR STANDARD DEVIATION = ',F10.3)                       Q  69
  995   18  FORMAT(T10,'PEAK DISCHARGE ERROR = ',F7.2,' PERCENT'///)                   Q  70
  996   19  FORMAT(   'ERROR ANALYSIS',T21,'ID I=',I1,T29,'ID II=',I1)                 Q  71
  997       END                                                                        Q  72-
```

```
 998          SUBROUTINE SEDT                                                  R   1
      C       THIS SUBROUTINE COMPUTES THE SEDIMENT YIELD FOR A FLOOD          R   2
 999          COMMON CFS(300),OCFS(300,6),IEND(6),DATA(310),DA(6),DP(20),NPU,NHD R   3
             1,SCFS(20),C(20),A(20,6),Q(20,6),RAIN(200),DEEP(20,6),NER,MAXNO,NCO R   4
             2MM,ICC,NCODE,DIST(6),SEGN(6),CTBLE(50,11),ITBLE(50,2),ZALFA(20),DT R   5
             3(6),TIME,PEAK(6),ROIN,ISG(6)                                    R   6
1000          ID=DATA(1)                                                       R   7
1001          SOIL=DATA(2)                                                     R   8
1002          CROP=DATA(3)                                                     R   9
1003          CP=DATA(4)                                                       R  10
1004          SL=DATA(5)                                                       R  11
      C       COMPUTE SEDIMENT YIELD                                           R  12
1005          X=ROIN*DA(ID)*53.333*PEAK(ID)                                    R  13
1006          SED=95.*X**.56*SOIL*CROP*CP*SL                                   R  14
1007          WRITE (6,3) SED                                                  R  15
      C       PUNCH CODE                                                       R  16
1008          IF (NPU) 2,2,1                                                   R  17
1009    1     WRITE (7,4) ID,SOIL,CROP,CP,SL                                   R  18
1010    2     RETURN                                                           R  19
      C                                                                        R  20
1011    3     FORMAT (10X, 'SEDIMENT YIELD = ', F10.1, ' TONS')                R  21
1012    4     FORMAT(    'SEDIMENT YIELD',T21,'ID=',I1,T29,'SOIL=',F5.3,T42,'CROP R  22
             1=',F5.3,T57,'CP=',F5.3,T70,'LS=',F5.3)                          R  23
1013          END                                                              R  24-

      //$DATA
```

ZALFA = 1234567890 *.,-

COMMAND TABLE

START	1	2
STORE HYD	2	310
RECALL HYD	3	310
COMPUTE HYD	4	310
PRINT HYD	5	2
PUNCH HYD	6	1
PLOT HYD	7	2
ADD HYD	8	4
STORE RATING CURVE	9	100
COMPUTE RATING CURVE	10	310
STORE TRAVEL TIME	11	100
COMPUTE TRAVEL TIME	12	5
ROUTE	13	4
ROUTE RESERVOIR	14	100
ERROR ANALYSIS	15	2
SEDIMENT YIELD	16	5
FINISH	17	0

-